CXR TELECOM 52

UNIVERSAL TRANSMISSION ANALYZER

MET54910

MODEL 5200-17
UNIVERSAL TRANSMISSION ANALYZER

Operation and Maintenance Manual

CXR Telcom Corporation
2040 Fortune Drive, #102, San Jose, California 95131

DISTRIBUTION STATEMENT - This publication is required for official use or for administrative or operational purposes only. Distribution is limited to U.S Government agencies.

This material may be reproduced by or for the U.S. government pursuant to the copyright license under the (DFAR) clause at 52.227-7013 (15 May 1987).

HANDLING AND DESTRUCTION NOTICE - Comply with distribution statement and destroy by any method that will prevent disclosure of contents or reconstruction of the document.

P/N 96-55200-100 Rev. B1

Model 5200-17 Universal Transmission Analyzer Operations Manual

Table of Contents

Section	Description	Page
1.	GENERAL	1
1.1	Introduction	1
1.2	Specifications	1
1.3	Furnished Equipment	3
1.4	Unfurnished Equipment	3
1.5	Tools and Test Equipment	3
1.6	Warranty Policy	3
1.7	Storage and Shipping Requirements	3
1.8	Safety Precautions	4
1.9	Electrostatic Damage Prevention	4
2.	PREPARATION FOR USE	7
2.1	Certification	7
2.2	Incoming Inspection	7
2.3	Repair Service	7
2.4	Powering the 5200	8
2.5	Functional Test	8
2.6	Connecting to the Line Under Test	9
3.	THEORY OF OPERATION	11
3.1	Overview	11
3.1.1	Analog Interface	11
3.1.2	Signaling	11
3.1.3	DS1 Interface	12
3.1.4	DSP	12
3.1.5	Controller	12
3.1.6	Input/Output	12
3.2	Block Diagram	12
3.2.1	CPU	12
3.2.2	Keyboard	13
3.2.3	Display	14
3.2.4	Data Interface	14
3.2.5	Power Distribution	14
3.3	TIMS Circuit Description	15
3.3.1	Analog Interface	15
3.3.2	Test Receiver	16
3.3.3	Test Generator	17
3.4	DSP Measurement and Signal Generation	18
3.5	Physical Description	19

Table of Contents (continued)

Section	Description	Page
4.	CONTROLS, INDICATORS, AND FUNCTIONS	21
4.1	Options	21
4.2	Front Panel	21
4.3	Rear Panel	23
4.4	Display	23
4.5	Functions	24
4.6	Test Selections-TMS/TIMS	25
4.7	TMS/TIMS Parameter Selections	27
4.7.1	Swept Frequency Test Parameters	27
4.7.2	Noise Test Parameters	27
4.7.3	Impulse Noise/Transients Test Parameters	28
4.7.4	Envelope Delay Test Parameters	28
4.8	Utilities	29
4.9	Dial Functions	29
4.10	TMS/TIMS Software-Defined Operations Keys	30
5.	GENERAL OPERATION OF THE 5200	31
5.1	Basic Operation	31
5.2	Function	32
5.3	Operating Steps	32
5.4	Main Screen	33
6.	OPERATION-TMS/TIMS	35
6.1	Test (Mode) Selection	36
6.2	Interface Setup	38
6.3	Test Setup Menus	40
6.3.1	Amplitude Response Test Menu	40
6.3.2	Impulse Noise Test Menu	41
6.3.3	Envelope Delay Distortion Test Menu	42
6.4	Test Procedures	43
6.4.1	Measuring Channel Loss	43
6.4.2	Measuring 3-Tone Slope and/or Attenuation Distortion	45
6.4.3	Measuring Noise	47
6.4.4	Measuring Impulse Noise-Transients	49
6.4.5	Measuring P/AR	51
6.4.6	Measuring Jitter (Amplitude and Phase)	53
6.4.7	Measuring Intermodulation Distortion	55
6.4.8	Measuring Return Loss	57
6.4.9	Measuring Envelope Delay Distortion	59
7.	BASIC DIALING FUNCTIONS	63
7.1	Dial-Up Interface	63
7.2	Dialing a Telephone Number	64
7.3	Dial Setup Menu	66

Table of Contents (continued)

Section	Description	Page
8.	UTILITY FUNCTIONS	67
8.1	Main 5200 Utilities	67
8.1.1	Date and Time	67
8.1.2	Remote Port Configuration	68
8.1.3	Keyboard Beep	68
8.2	Test Function Utilities	68
8.2.1	Results Files	68
8.2.2	Defaults	69
8.2.3	Self Test	69
9.	ACCEPTANCE TEST AND CALIBRATION PROCEDURES	71
9.1	Introduction	71
9.2	Test Equipment Required	71
9.3	Safety Precautions	71
9.4	Preventative Maintenance	72
9.4.1	Cleaning	72
9.4.2	Circuit Board Inspection	72
9.5	Performance Verification	73
9.5.1	Required Test Equipment	73
9.5.2	Continuity Check	73
9.5.3	DC Blocking	73
9.5.4	Self Test	73
9.5.5	Transmit Level Check	74
9.5.6	Transmit Frequency Response	74
9.5.7	Transmit Impedance	75
9.5.8	Total Harmonic Distortion	75
9.5.9	Transmit Quiet Termination	76
9.5.10	Receive Level	76
9.5.11	Receive Impedance	77
9.5.12	Receive Frequency Response	77
9.5.13	Receive Frequency Measurement	78
9.5.14	Receive Noise Measurement	78
9.5.15	Notch Filter	79
9.5.16	Noise-to-Ground	80
9.5.17	Receive Filter Characteristics	80
9.5.18	Return Loss - 4 Wire	81
9.5.19	Return Loss - 2 Wire	81
9.5.20	Impulse Noise	81
9.5.21	P/AR	82
9.5.22	Speaker Operation	82
9.5.23	Holding Circuits	83
9.5.24	Dial and Talk	83
9.5.25	Back Light	83
9.5.26	Contrast Control	83
9.5.27	Printer	84

Table of Contents (continued)

Section	Description		Page
	9.5.28	Real Time Clock	84
	9.5.29	Battery Operation	84
	9.5.30	Nonvolatile Memory	84
	9.5.31	Envelope Delay Distortion	84
	9.5.32	Phase and Amplitude Jitter	85
	9.5.33	Hits	86
	9.5.34	Intermodulation Distortion (IMD)	87
9.6	Calibration Procedures		88
	9.6.1	Required Test Equipment	88
	9.6.2	Set Real Time Clock	88
	9.6.3	Calibrate VF Receiver	88
	9.6.4	Calibrate Noise-toGround	90
	9.6.5	Calibrate Program Band Receiver	90
	9.6.6	Calibrate Wide Band Receiver	91
	9.6.7	Calibrate VF Transmitter	91
	9.6.8	Calibrate Program Band Transmit	93
	9.6.9	Calibrate Wideband Transmit	93
	9.6.10	Calibrate Hybrid Loss	94
	9.6.11	End Calibration	94
10.	TROUBLESHOOTING AND REPAIR		95
10.1	Tracing Source of Specific Malfunction		95
10.2	Repair Procedure		97

Component Manufacturer's Cross-Reference Listing

This section lists the following for cross reference: A1-20
Assembly Name and Number; CXR Part Number; and
Manufacturer's Name and Part Number

PARTS LIST #		
--	REPLACEABLE PARTS LIST	A-1
18-55200-170	5200-17 FINAL ASSY (NAVY)	B-2
21-55200-170	BASIC ASSY, 5200-17	B-3
25-55200-010	CABLE, 3-DAISY CHAIN, 5200	B-4
23-55200-013	TESTED PC ASSY, MAIN BOARD, 5200	B-5
23-55200-019	PC ASSY, MAIN BOARD, 5200	B6-8
23-55200-021	TESTED PC ASSY, ANALOG BOARD, 5200	B-9
23-55200-020	PC ASSY, ANALOG BOARD, 5200	B9-11
26-55200-011	FRONT PANEL ASSY, 5200-02	B-12
25-55200-020	CABLE, XMIT/RECEIVE TEL JACK, 5200	B-12
25-55200-030	CABLE, CONTRAST/VOLUME, 5200	B-13
25-55200-040	CABLE, LCD BACKLITE, 5200	B-13
25-55200-050	CABLE, LCD DISPLAY, 5200	B-13
26-55200-021	REAR PANEL ASSY WITH BATTERIES, 5200-02	B-14
25-55200-060	CABLE, SPEAKER, 5200	B-14
25-55200-090	WIRE HARNESS, SPRING. 5200	B-15
25-55200-140	CABLE, GROUNDING, 5200	B-15
25-55200-170	CABLE, FAN, 5200-02	B-15

List of Illustrations

Figure	Title	Page
1-1	Static Awareness	5
2-1	Line-Under-Test Connections	9
3-1	Functional Modules of the 5200	10
3-2	Block Diagram of 5200	11
3-3	Power distribution	13
3-4	Analog Line Interface	14
3-5	A/D	15
3-6	DSP	17
3-7	5200 Front Panel	18
3-8	5200 Rear Panel	18
4-1	Description Sequence	22
5-1	General Operating Procedure for the 5200	29
6-1	Menu Map for TMS Function	32
7-1	Operating Sequence from DIAL Function	60
10-1	Troubleshooting Procedure	98

PARTS LIST

Drawing Number	Title	
96-55200-001	5200 PRODUCT TREE	C-1
18-55200-170	5200-17 FINAL ASSY (NAVY)	C-2
21-55200-170	BASIC ASSY, 5200-17	C3-5
25-55200-070	CABLE, 3-DAISY CHAIN, 5200	C-6
25-55200-080	CABLE, 4-DAISY CHAIN, 5200	C-7
23-55200-013	TESTED PC ASSY, MAIN BOARD, 5200	C-8
23-55200-010	PC ASSY, MAIN BOARD, 5200	C9-18
23-55200-021	TESTED PC ASSY, ANALOG BOARD, 5200	C-19
23-55200-020	PC ASSY, ANALOG BOARD, 5200	C20-23
26-55200-010	FRONT PANEL ASSY, 5200	C24-26
25-55200-020	CABLE, XMIT/RECEIVE TEL JACK, 5200	C-27
25-55200-030	CABLE, CONTRAST/VOLUME, 5200	C-28
25-55200-040	CABLE, LCD BACKLITE, 5200	C-29
25-55200-050	CABLE, LCD DISPLAY, 5200	C-30
26-55200-020	REAR PANEL ASSY WITH BATTERIES, 5200	C-31
25-55200-060	CABLE, SPEAKER, 5200	C-32
25-55200-090	WIRE HARNESS, SPRING. 5200	C-33
25-55200-120	CABLE, FAN, 5200	C-34

1. GENERAL

1.1 Introduction

The CXR Model 5200-17 is a full-function transmission impairment test instrument used to test transmission characteristics of an analog channel. The 5200-17 provides a frequency range from 40 Hz to 200 kHz. In addition to performing all measurements specified by IEEE 743, the 5200-17 meets the requirements for HDSL subscriber loop testing. The 5200-17 is equipped with full transmission impairment testing capability as follows:

> Measurement capability includes Level and Frequency, Noise, Impulse Noise, P/AR, Return Loss, Transient Hits, Phase/Amplitude Jitter, Intermodulation Distortion, and Envelope Delay Distortion.
>
> Test connections can be made to balanced 2- or 4-wire lines. Dial and Hold capability for 2-wire dial-up lines is provided. Measurement range is 20 Hz to 200 kHz. The 5200-17 operates from commercial 110 VAC, 60 Hz power or internally rechargeable batteries.

The 5200-17 is suitable for both portable and rack mounted applications. A 19" rack mounting kit is included which enables rack mounting in accordance with the convertable/rack mount requirements of MIL-T-28800.

1.2 Specifications

Test Function		
TMS		Level & Frequency
		Noise
		Impulse Noise
		Return Loss (VF)
		P/AR (VF)
TIMS (VF)		IMD
		Transients
		Phase Jitter
		Amplitude Jitter
		EDD
Analog Interface		
Bandwidth		40 Hz – 200 kHz
Ranges		VF, Program, Wideband
Level	Xmt:	–40 to +13 dBm
	Rcv:	–60 to +13 dBm
Interface		VF/2-wire
		VF/4-wire
		Program (2-wire)
		Wideband (4-wire)
Holding circuit		Electronic; 23 mA
Impedance	VF/2W:	600, 900, 150, 1200 Ω
	VF/4W:	600, 900 Ω
	Prog:	150, 600, 900 Ω
	WB:	135 Ω
Bridged Rcvr		>50 kΩ
Jacks		310 compatible; RJ-11
Level & Frequency Test		
Modes		Single tone
		Selected tones
		3-tone Slope (VF)
		Amplitude Response
Sweep control		single, auto, manual, six tones
Sweep range	VF:	40–5000 Hz
	Prog:	0.1–20 kHz
	WB:	0.1–200 kHz
Step size	VF:	1 Hz
	Prog:	10 Hz
	WB:	100 Hz
Sweep rate	fast:	3.5 secs. per step (approx.)
	medi:	5 secs. (approx.)
	slow:	10 secs. (approx.)
Receive TLP		–16 to +16 dB

General

Reference		manual control, (1004 Hz)
Mask		3002, C1–C5; D6
SF Skip		2450–2750 Hz
Loopback Freq.		2713 Hz, 2863 Hz, user programmable
Flatness		±0.1 dB @ 1004 Hz ±0.2 dB, 200–15 kHz ±0.5 dB, 15–200 kHz

Noise Measurement

Modes		S/N; noise-with-tone; idle noise; noise-to-ground (VF)
Filters	VF:	C-message; 3-kHz Flat; 1010 Hz notch
	PROG:	Weighted, 15-kHz Flat
	WB:	50 kbit (497F)
Range		10–45 dB S/N 10–90 dBrn (balanced) 40–130 dBrn (to-ground)
Resolution		1 dB

Impulse Noise

Modes	VF:	with/without 1004 Hz tone
	PROG:	idle circuit
	WB:	idle circuit
Filters	VF:	C-notch/message
	PROG:	Weighted, 15-kHz Flat
	WB:	50 kbit (497F)
Threshold (1st)		30–110 dBrn
2nd level		+4 dB
3rd level		+8 dB
Count rate		8 pps, >99 pps
Counter capacity		9999
Timer		1–999 minutes

Transients/VF (TIMS option)

Mode	Measured with 1004 Hz tone
Measurements	Impulse Noise Gain Hits Phase Hits Dropouts
Gain threshold	2–10 dB; 1 dB steps
Phase threshold	5–45°, 5° steps
Dropouts	–12 dB

P/AR Test

Output level	–40 to 0 dBm
Range	0–120 units
Resolution	1 unit

Return Loss

Configuration	VF/2- or 4-wire
Modes	ERL; Structural RL
Output level	–40 to –10 dBm
Test signals	ERL, SRL-L, SRL-H, swept tone
Range 2w:	0–40 dB
4w:	0–50 dB
Balanced net.	900 Ω + 2.16 µFd
Resolution	1 dB

Intermodulation Distortion

Method	Non-linear Distortion
Signal	4-tone, A & B pairs
S/N check	2-tone, A pair + 3 dB
2nd order filter	520 Hz and 2240 Hz
3rd order filter	1900 Hz
Input level	–40 to 0 dB
Range	–55 to 0 dB
Resolution	1 dB

EDD

Configuration	Measure/Repeat
Mode	Forward/Return reference
Slave repeat	Phase & Level
Frequency control	single, auto, manual sweep
Modulation	83.3 Hz
Level range	–40 to 0 dBm
Measurement range	-3000 to +9000 µsec
Level (slave)	–10 to +10 dB
Resolution	1 µsec; 0.1 dB
Accuracy	± 10 µsec; 600–3500 Hz ± 30 µsec; 300–600 Hz
Phase reference	1804 Hz, automatic
Level reference	1004 Hz, manual
Conditioning	3002, C1–C5, D6

Phase & Amplitude Jitter

Transmitter	1004 Hz
Receiver range	990–1030 Hz
Input level	–40 to +10 dBm
Jitter frequency	STD (20–300 Hz) STD + LF (4–300 Hz)
Measurement	0–90 ° or %, peak-peak
Resolution	0.1 ° or %
Accuracy	5%

General

Printer	Parallel, Epson compatible
Power	115/220 Vac; 50 Watts
Battery	10 size D cells; 4 Amp-Hr.
Capacity	approx. 3 hours (TMS/TIMS only)
Charge	24 hours
Temperature	0° to +50°C (operating) –40° to +60°C (storage)
Dimension	13.0" x 13.5" x 5.0"
Weight	16 lb.

1.3 Furnished Equipment

A 7-foot AC power cord and an operating manual are furnished with each test set. In addition, the 5200-17 includes (2 each) 19" rack adapters: P/N 44-55200-220.

1.4 Unfurnished Equipment

The user will have to provide any of the following items that may be needed for use:

- Test cords (metallic interface) with 310 type plugs for connection to test set and appropriate plug for connecting to the line under test.

1.5 Tools and Test Equipment

Test equipment is listed at the beginning of each test procedure. This test equipment is required for the performance tests, adjustments, and repair. Any equipment that satisfies the critical specifications given may be substituted for the recommended model.

1.6 Warranty Policy

Products manufactured by CXR Telcom Corporation are guaranteed to be free of defects in materials and workmanship for a period of two years from the date of shipment. CXR Telcom will accept returned items, transportation prepaid to the service center, for repair during the warranty period at no cost to the customer, provided that the products have not been subjected to improper installation, accident, misuse, neglect, or unauthorized alterations.

1.7 Storage and Shipping Requirements

Environmental conditions during storage and shipment should be limited to a maximum temperature of 50° C and minimum temperature of -40° C.

The equipment may be prepared for storage and shipment by one of several methods. A heavy-duty shipping trunk (CXR Part Number TRUNK-01) is recommended for transporting the instrument via common carrier, or a field case (CXR Part Number CASE-06) is available for general protection of the test system during periods of handling and field use.

CAUTION
Although the 5200-17 is a rugged, portable test set, it is not advisable to ship the unit by common carrier while installed in a CXR padded field case; damage to the equipment may result.

The 5200-17 can also be repacked in the original shipping container (if available) or with other commercially available materials, as follows:

(1) Use the original shipping container designed for the equipment; otherwise a strong crate or carton to provide adequate protection.

(2) Wrap the equipment in heavy paper or plastic before placing it in the shipping container.

(3) Completely fill area around the equipment with shock absorbing materials.

(4) Seal the shipping container with strong tape or metal bands and attach a packing list to an outside surface.

1.8 Safety Precautions

As with other instruments, general safety precautions must be observed during any part of operation, service, and repair of the Model 5200-17.

(1) **Voltage:** Dangerous voltage potentials (such as the 120/240 AC power line) are present inside and under the main circuit board when the 5200-17 covers are taken off. This voltage level is capable of causing death or serious injury. Be certain to unplug the power cable before performing cleaning, inspection, calibration, or repair routines.

(2) **Fuses:** Never us a fuse other than one of the specified rated value.

(3) **Power:** Never operate the test set from an AC line different than that specified on the rear panel voltage selector.

(4) **Cleaning:** The recommended cleaning solution for the exterior surface of the 5200-17 is 1% mild common household soap to 99% water.

(5) **Battery:** The 5200-17 utilizes high output energy NICKEL-CADMIUM batteries which, when fully charged and accidentally shorted, are capable of melting wire and metals, explosion, starting a fire, or spewing out hot, strong-alkaline electrolyte oxygen and hydrogen gases. Be certain to remove any metal from your body (such as metal watchbands, rings, or bracelets, etc.) when servicing the 5200-17 with NiCAD batteries installed.

(6) **Soldering:** Soldering of wires and components must be performed only by personnel familiar with the techniques that produce the desired results without risking damage to or causing future malfunction of the equipment. An approved electrostatic discharge protected solder iron and desolder pump is required.

(7) **Unauthorized Modifications:** Because of the danger of introducing additional hazards, do not perform any unauthorized modification to the equipment.

(8) **Parts Removal:** Do not remove components from the circuit board assemblies unnecessarily. Before replacing new components, be sure that lead wires/pins are properly aligned so damage does not result. Replacement parts must be installed with correct orientation and/or observance of polarity.

1.9 Electrostatic Damage Prevention

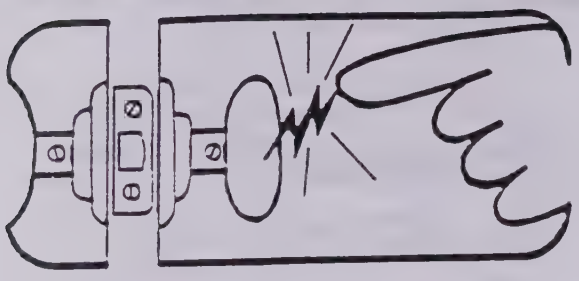
Modern electronic equipment makes extensive use of micro-electronic circuitry which can easily be damaged if improperly handled. All service work should be carried out only in an area where safety measures against electrostatic damage (ESD) have been taken. The object is to prevent the build-up of static electricity on any tools, the bench surface, replacement parts, printed circuit boards, or the technician. Even an invisible discharge of static electricity across a sensitive circuit can destroy the device.

Figure 1 depicts the appropriate procedures to avoid electrostatic discharge.

static awareness

A Message From

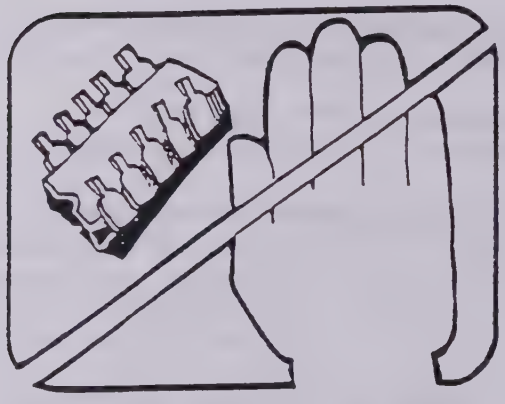
CXR Telcom Corporation



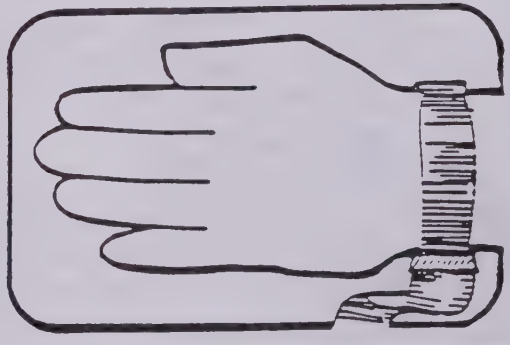
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

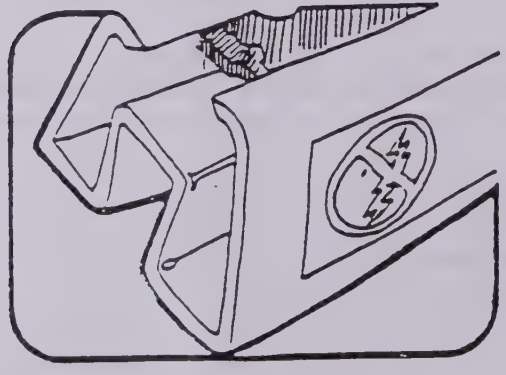
The following practices should be followed to minimize damage to S.S. devices.



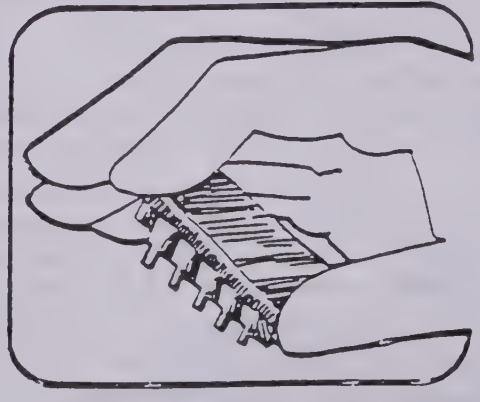
1. MINIMIZE HANDLING



3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES

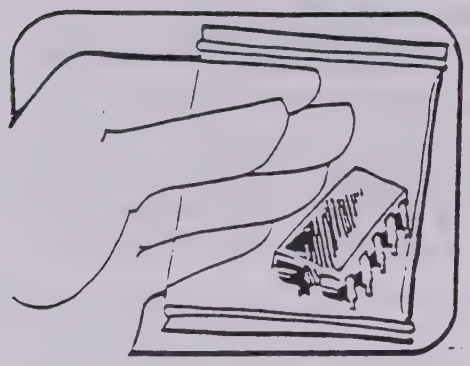


2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.

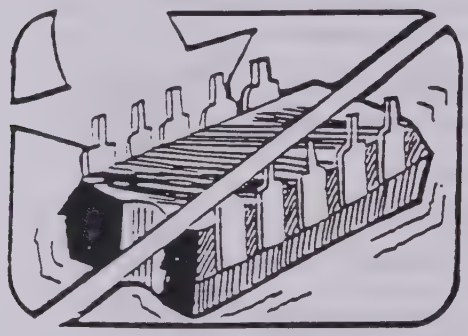


4. HANDLE S.S. DEVICES BY THE BODY

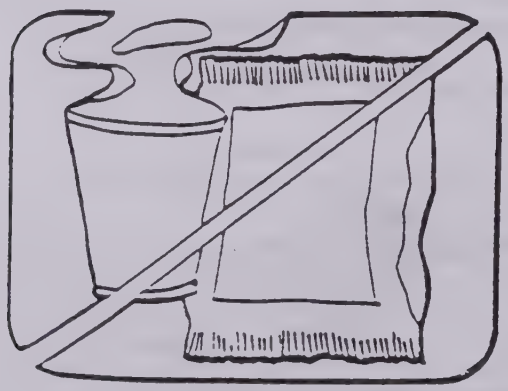
Figure 1-1: Electrostatic Discharge Warning



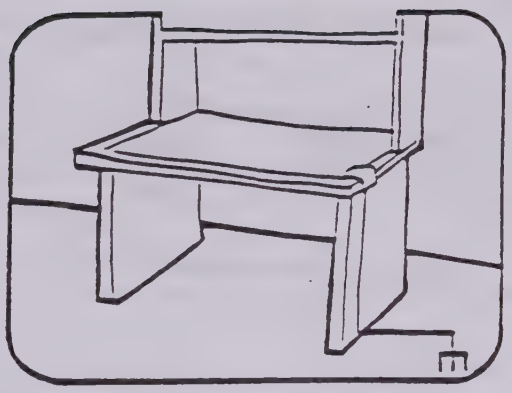
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYRAFOAM IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Figure 1-1: Electrostatic Discharge Warning (Continued)

2. PREPARATION FOR USE

2.1 Certification

CXR Telcom Corporation certifies that all instruments are thoroughly tested and inspected and found to meet published specifications when shipped from the factory. Modern packaging techniques are used to prevent damage during shipment.

2.2 Incoming Inspection

An incoming inspection should be performed to verify that the 5200-17 is received in good working order. This inspection should consist of the following steps:

(1) Check to determine if the carton and/or packing materials have sustained any damage during shipment.

(2) Visually inspect the 5200-17 for any broken terminals or control knobs.

(3) Perform the circuit board inspect described in Part 8.

(4) Perform the performance verification procedure described in Part 8.

If it is determined that damage occurred during shipment, a claim should be filed with the carrier immediately. Normally, the carrier will want to inspect the shipping carton and packing materials.

2.3 Repair Service

If equipment does not operate properly when tested according to the instructions, it should be returned to CXR for repair. Call Customer Service for a Return Material Authorization prior to shipping any equipment to the factory. When returning equipment , upmost care should be taken to avoid shipping damage. If available, use the original cartons and packing material. Shipping charges should be prepaid.

If the equipment is covered by warranty, it will be repaired free of charge or replaced, at the Company's option, and returned prepaid. Unauthorized field repairs or modifications will invalidate the warranty.

For out-of-warranty repair work, Customer Service will provide a quotation for repair charges first, unless the shipment is accompanied by a purchase order. Repair work will be performed after authorization to proceed (in the form of a purchase order) is received.

Service Center
CXR Telcom Corporation
Attn: Customer Service
2040 Fortune Drive, Suite 102
San Jose, CA 95131
(408) 435-8520

2.4 Powering the 5200-17

AC Power

The 5200-17 may be powered from 110 or 220 VAC, 50/60 Hz. The internal power supply is fused by 0.5 AMP slow-blow fuse.

Before plugging the 5200-17 into the AC power source, check that the rear panel 110/220 VAC selector switch is set to the proper voltage. The unit is factory set to operate at 110 VAC.

Internal Battery Power Source

Ten "D" sized NiCad rechargeable batteries are shipped with the unit and must be installed according to the procedure described below. Under normal TMS/TIMS operation, battery life is approximately 3 hours.

To install batteries:

(1) Remove the screws securing the retainer cover on the rear panel.

(2) Turn the receptacle covers in the counter-clockwise direction and remove.

(3) Push aside the contact spring that is attached to the wall of the receptacle.

(4) Remove old batteries and replace with new ones, being sure that the "+" side of the batteries face toward the rear of the unit.

(5) Replace the contact spring between batteries and receptacle cover. Then replace receptacle covers and retainer plate.

Batteries are recharged whenever AC voltage is supplied to the set, whether or not the set is turned on or not. The charge rate is approximately 1/10 the ampere-hour rating when the unit is turned on or off. Recharge time is 24 hours.

> WARNING
> **Applying AC power with "alkaline" batteries installed could result in damage to the equipment and possible injury.**

2.5 Functional Test

A functional check of the 5200-17 should be made to ensure that it is working when it is placed in service. The following quick check is not intended to be a substitute for a detailed acceptance test procedure.

(1) Turn set ON by turning VOLUME knob clockwise past the detent.

(2) When the Main screen appears, check the time and date. If incorrect, a means for setting the correct time is available in UTILITIES.

(3) Press the <TMS> softkey. A Test Selection menu will appear. Check that the header shows that unit is in 4W, 600 ohms, and terminated. If not, press SETUP key and change.

(4) Move cursor to Level/Frequency on the Test Selection menu and press the SELECT softkey. This display will show the level and frequency of the transmitted test tone.

(4) Move cursor to Level/Frequency on the Test Selection menu and press the SELECT softkey. This display will show the level and frequency of the transmitted test tone.

(5) Connect a patch cord between the RCV and the XMT jacks on the front panel. The received signal will be detected and measured. The receive measurement should be within a digit of those shown for the transmitted signal.

2.6 Connecting to the Line Under Test

4-Wire : Connect transmit circuit to the XMT jack or RJ11 jack on the front pane. Connect receive circuit to the RCV jack or RJ11 jack on the front panel.

2-Wire : Connect circuit to either the XMT jack or RJ11 jack on the front panel. (A softkey within the measurements allows you to transfer between transmit and receive functions.)

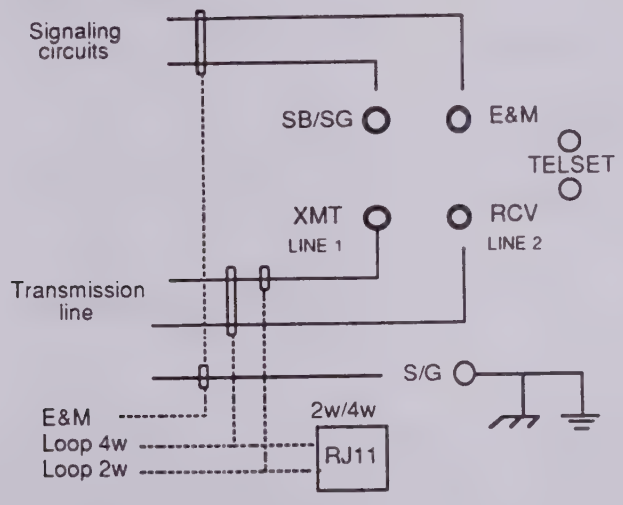


Figure 2-1: Line-Under-Test Connections

This page intentionally left blank.

3. THEORY OF OPERATION

The 5200-17 is a microprocessor based, software driven system; thus, a knowledge of hardware operation does not provide complete understanding as to how the test set works. Upgrades in firmware can significantly change the functions and features of the unit without changing the hardware. Software architecture and design are not described in any detail in this manual.

3.1 Overview

The basic 5200-17 contains the main logic board (which includes a power supply) and the analog interface and measurement board. It is housed in a rectangular enclosure designed for desktop use. It also may be rack mounted by using optional hardware.

Figure 3-1 and the following paragraphs describe the major functions of the 5200-17.

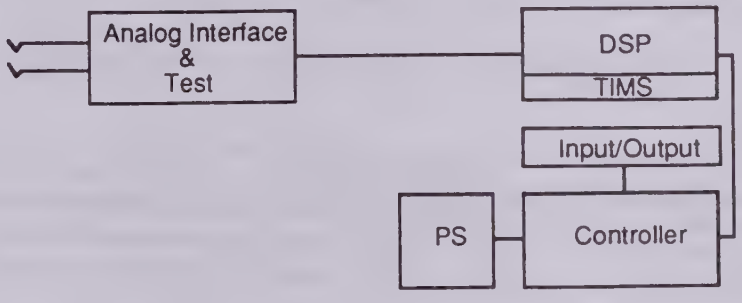


Figure 3-1: Functional Modules of the 5200-17

3.1.1 Analog Interface

VF, program channel, or wideband network circuits are connected to the Analog Interface module via jacks located on the front panel. Basic circuit conditioning functions are provided but for complex signaling operations, the lines are routed to the Signaling module. Various switching functions are performed, and the balanced transmission lines are then bridged to single ended test circuits via capacitors and a balanced transformer. Interface type selection, level coordination, analog/digital conversion (receive), and digital/analog conversion (transmit) are performed. The converters are interconnected with the DSP devices on the Main PCB (MB) via a serial data bus which has data, clock, and frame leads and runs at rates ranging from 576 kb/s to 12 Mb/s.

3.12 DSP

Dual DSP chips perform measurements and generate signal patterns. A single serial data bus interconnects the two devices on the main PCB with the line interface modules. Test routines are controlled by software which is uploaded from the Controller as needed.

3.13 Controller

The microprocessor based controller directly handles all functions within the test set. Modules communicate only with the controller, not with each other. It includes the microprocessor, memory, timers, clock, and buffers.

3.14 Input/Output

Input/Output devices including the display, keyboard, external data and printer ports, and indicators are controlled directly by the Controller. The speaker volume, however, is controlled directly by the front-panel control provided for that purpose.

3.2 Block Diagram

Figure 3-2 shows a simplified block diagram of the basic test set. Device designators are those shown on the main or Analog Board schematics. Drawing locations in the following description identify the board/sheet number-drawing coordinates. Schematics are reproduced in section 8 of this manual. Analog line interface and test/measurement circuits are described in more detail in sections 3.3 and 3.4. A description of the optional Signaling and DS1 interfaces are not included in this manual.

> *Convention*: In the following material, component locations are identified by Reference designation; Board/sheet-coordinates. For example, the watchdog timer (U29; MB/3-C7) is part U29, located on the Main Board, sheet 3 at drawing coordinates C7.

3.2.1 CPU

The controller (CPU) consists of a microprocessor, read-only-memory (ROM), random-access-memory (RAM), counter-timer controller, watchdog timer, and various buffer and auxiliary circuits. The processor (U5; MB/1-D6) is a 16-bit device (type 80C186) which controls operations via an Intel 20 line multiplexed address/data bus. A maximum of 1 MB of memory can be addressed and 128 kb of RAM is equipped. The CPU clock rate is 10 MHz. A watchdog timer (U29; MB/3-C7) is periodically refreshed by the CPU in normal operation. If the cycle time fails (because software is hung up in a loop), the timer performs a reboot operation.

The 5200-17 firmware resides in four EPROMs (U6, 7, 10, 11) which will generally be replaced as a set to upgrade software. A self-test, which may be run under manual control, compares the actual ROM count to a number which is stored in the last byte of memory in order to verify the integrity of the software. A software failure can be repaired only by replacing the entire ROM set. The software version number is included in the initial (power-up) display.

Four SRAM devices provide 128 kB of memory for operations. Two SRAM chips (U16, 17), with 64 kB of memory, are powered by internal batteries to provide non-volatile storage of parameter settings and test results. The Signaling Board and the DS1 Board each have an additional 64 kB of non-volatile RAM. If the integral lithium batteries fail, the entire memory unit must be replaced.

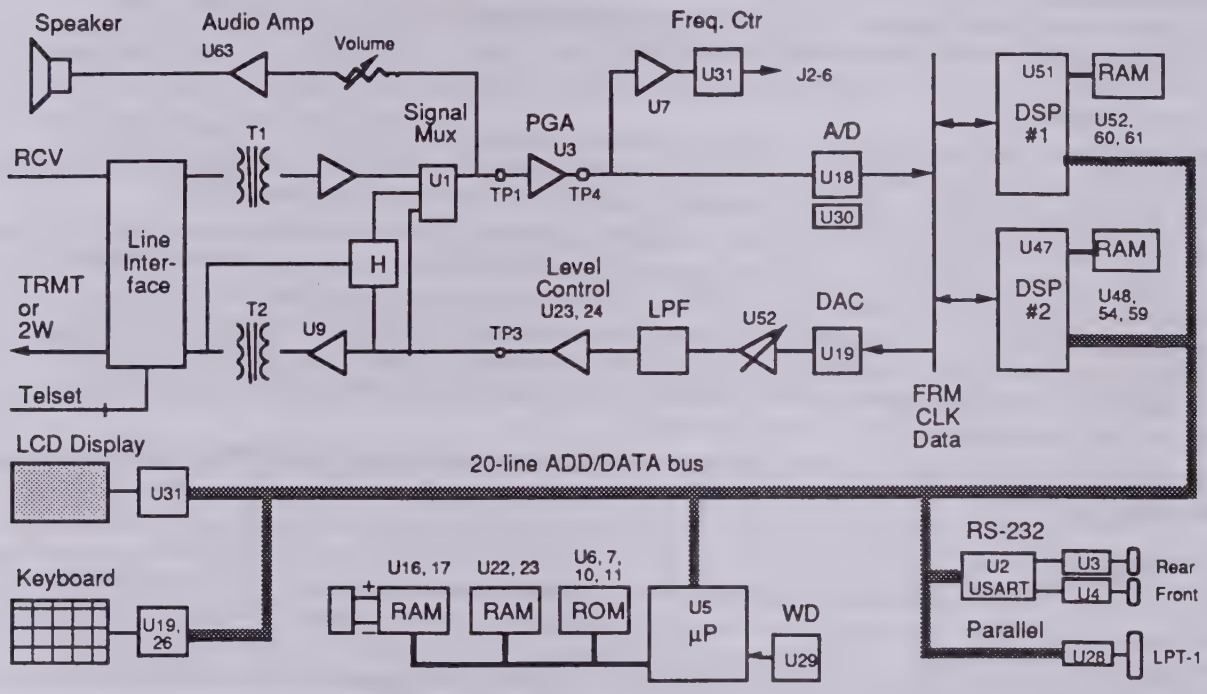


Figure 3-2: Block Diagram of 5200

3.2.2 Keyboard

Electrically, the 28 front panel keys are divided into two panels, in a 4x4 matrix which includes the number pad and a 3x4 matrix which includes all other keys.

The scanner-decode circuits (U19, 26; MB/3-B4) scan each row of the panel at a 1 kHz rate while simultaneously monitoring each column of the matrix for continuity to the scanning signal. When a closure is detected, the key coordinates are stored in the keyboard register (U18) in an X-Y form and the "data available" signal line to the µP is set. The key identity is translated to an eight-bit binary word by the µP. The processor retrieves the data and resets the latch. Software interprets the 8-bit word as a specific key input. Valid commands are executed, undefined commands are simply ignored.

A contact closure must exist for as long as 5 msec before it is recognized. Exact timing is determined by a capacitor (C32, 40). After the first contact closure is detected, further key-panel activity is locked out until the register is read and cleared by the controller. Software builds in a dead time of 300 msec to prevent multiple inputs from a single, long, key operations. Keyboard input is acknowledged with a short audible beep which is generated by gating the 1 kHz clock signal through an audio switch (U63) to the speaker. No distinction is made between a valid signal and an illegal command, although the later will be ignored.

3.2.3 Display

The 160 x 128 pixel LCD can be operated in character, graphics, or intermixed modes. In character mode, the character generator produces a standard display of 20 characters by 16 lines. This mode is used to show variable parameters and measured data because it requires very little computation.

In the graphics mode, each pixel is addressed separately and a considerable amount of processor time is consumed to format the display. Graphics mode is used for fixed format messages, menus, masks, and charts of measured data.

Measured data is processed in real time and stored in scratchpad memory as the test progresses. Update cycle time varies with the test. Fixed screen data (menus) is stored in ROM, and set-up parameter selections are stored in RAM which has an integral battery. Information which is to be displayed is converted into characters and coordinate locations and routed to the display. The display is refreshed at the rate of 4 times per second.

3.2.4 Data Interfaces

Two serial data ports are provided for connecting external devices; one on the front panel and one on the rear. A dual channel USART (U2; MB/3-C6) drives two RS-232C Driver/Receivers (U3, 4). A parallel printer port connector (LPT-1) is driven directly by the μP data bus, via a latch.

The RS-232C connection is used to transmit and receive data in serial form. The data timing is asynchronous and standard ASCII characters are used. Each character consists of a START bit, up to eight CHARACTER bits, and a STOP bit. A character has no fixed timing with respect to the previous character; thus, is described by the term *asynchronous* data format. Parameters which are determined by user selection include the number of bits per character (7, 8), the number of stop bits (1, 1.5, 2), and the rate of transmission (300 to 9600 b/s). In the 5200 these variables are selected from a menu and maintained in non-volatile memory.

A standard USART provides the interface between the internal data bus of the test set and the external serial interface.

3.2.5 Power Distribution

Voltage (110/220) is selected on the AC input connector located on the rear panel. Input voltage is stepped down to 28 Vac by the dual input winding transformer and rectified to 30 Vdc by CR1. This unregulated voltage is distributed to the DS1 PCB which has an integral voltage regulator. A DC-DC power supply (PS1; MB/2-D2) on the Main PCB provides regulated +5 and ±12 Vdc to circuitry on the Main and Analog PCBs.

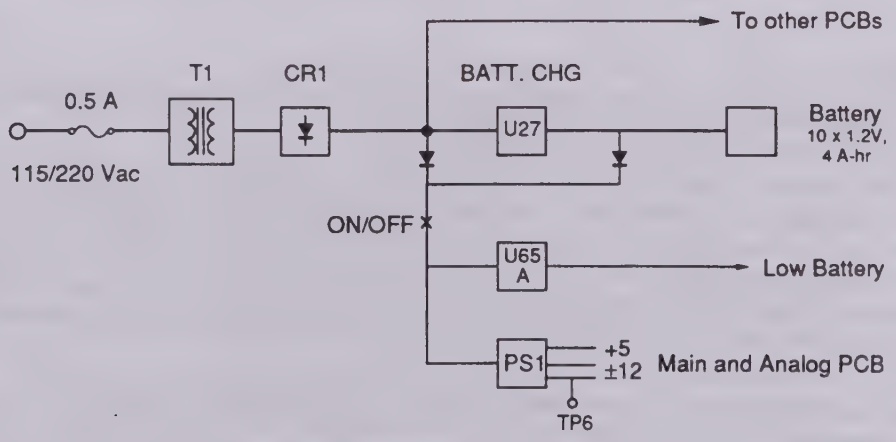


Figure 3-3: Power Distribution

NiCad batteries are maintained by a constant current charger (U27) which is "on" whenever the set is supplied by external AC power. Passive switching to battery power is used when batteries are equipped. Voltage (at the unregulated level) is monitored behind the power switch by U65A.

3.3 TIMS Circuit Descriptions

The analog transmission interface, gain adjustment, signal switching, filters, and A/D conversion are located on the Analog Board (AB). Test signal generation and measurement circuitry is located on the Main Board (MB). For clarity, circuit operation will be described by function, as follows: line interface, receiver, and transmitter.

3.3.1 Analog Interface

The 5200 can connect to a two-wire or a four-wire metallic circuit. Basic (dial/hold) signaling functions are provided for one two-wire interface.

The dial-pulse circuit places a low resistance shunt across T/R to momentarily "open" the loop. The shunt causes the electronic holding circuit to drop out when it senses the shorted loop. Dial-pulse timing can be accurately controlled by adjusting the circuit constants to values which produce the desired 66/34% break/make ratio. DTMF and MF tone signals are generated by the Transmit DSP.

The Receive line may be bridged (no termination) or terminated in 600, 900, 135, 150, or 1200 Ω. Similar source impedance may be independently selected for the transmitter. The Receive line also has a balanced-to-simplex conversion bridge for use in making a Noise-to-ground measurement. This bridge in effect center taps the balanced line (Tip/Ring), then creates a circuit with this as one lead and ground as the other. Loss of signal level in this bridging operation is compensated by amplification.

VF signals are bridged to the balanced transformer input circuit through capacitors, making these circuits dry insofar as carrying DC (loop) current is concerned. Transformers interface the balanced line to single-ended test and measurement circuitry.

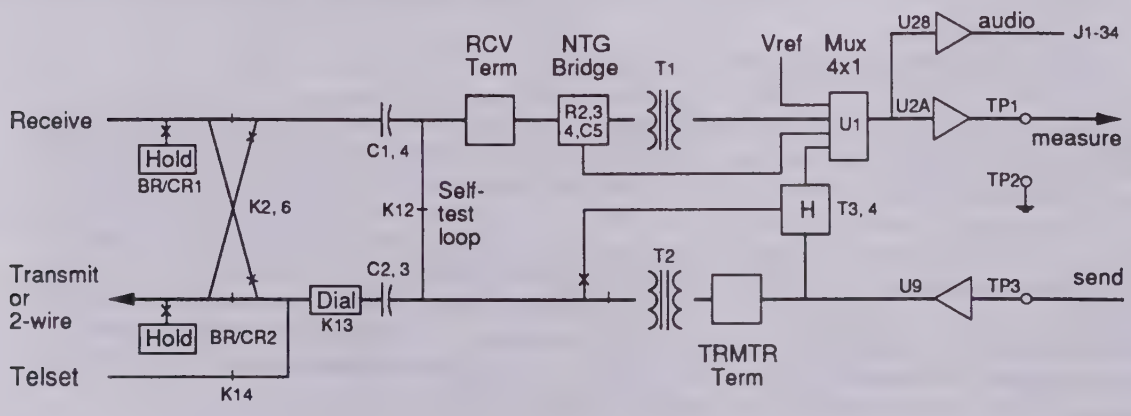


Figure 3-4: Analog Line Interface

332 Test Receiver

The analog receiver has a balanced input, provided by a transformer coupled circuit which is isolated from the line input by capacitors. A 8x1 analog multiplex (U1,AB/1-D2) connects the input signal, a noise-to-ground input, the receive leg of a hybrid, the transmitter output, or a reference voltage to the receive amplifier chain. The Programmable Gain Amplifier chain (U3; AB/1-B4) adjusts the signal level to fall within the range of the analog-digital converter (ADC). Factory adjustments include gain adjust control (R52) and offset adjustment (R72). These controls should not be reset during re-calibration. Following level adjustment, the analog signals are converted to digital format by the A/DC (U18; AB/2-D6).

Conversion to a digital signal which provides wide dynamic range and high resolution is based on the delta-sigma modulation technique. The analog input signal covers a bandwidth from 40 Hz up to 200 kHz, and has a dynamic range from a low of –90 dBm to a high of +13 dBm. The A/D converter must translate the analog signal to a binary word suitable for processing by the DSP measurement device. The sigma-delta technology samples the input at a very high rate, then sums and filters the samples in such a way that most quantizing noise is rejected in order to achieve a 96 dB dynamic range with an extremely high S/N (90 dB). Figure 3-5 illustrates the steps involved.

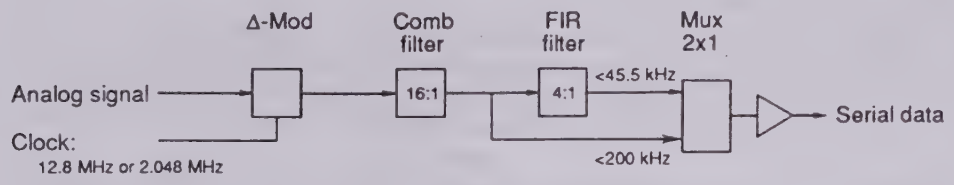


Figure 3-5: A/D

The sample rate of the analog input is determined by the bandwidth setting of the 5200, as shown in the following table. Clock-in is divided by 2 in the delta-mod stage, thus, the final sample rate equals clock-in divided by 128. The output via the serial data bus is a framed 16-bit word.

Frequency (Hz)	Clock-in (MHz)	Sample Rate* (per/sec)	Bit-rate (kbit/s)
VF, 40–4k	1.024 2.048	8k/s 16 k/s	128 kb/s 256 kb/s
Program, 40–20k	12.8	100k/s	1.6 Mb/s
Wideband, 20k–200k	12.8	400k/s	6.4 Mb/s

* Effective sample rate, after decimation.

The delta-mod encoder has a 1-bit output which indicates whether the present sample is greater or less than the previous sample. The oversampling technique eliminates the need for an anti-aliasing filter in the input—which would be extremely difficult to implement for wideband applications. It also spreads quantizing noise (which results from the A/D process) over a very wide spectrum. Most of the noise is easily filtered out by the third order comb filter which follows the delta-mod stage. This results in an extremely high S/N after all processing is completed and full 15-bit stability in the output. First stage processing also includes decimation which reduces the sample rate by 16:1 (VF signal to 32 kHz). The output of the first digital filter drops with frequency, a characteristic which is compensated in the second (FIR) filter stage. A second filter stage provides 4:1 decimation which reduces the final sample rate of a VF signal to 8 kHz.

Two-stage digital filtering and decimation yields a maximum sampling rate of 100 kHz; which translates to an upper frequency limit of 45.5 kHz. For higher frequencies, the output is taken directly from the comb filter which provides an upper frequency limit of 200 kHz. The non-linear frequency response at high frequencies is compensated in the DSP measurement stage. The comb filter output yields 12-bit resolution.
The analog sample is encoded into a 16-bit binary form per sample and routed to the DSP for measurement via the serial data bus. Although multiple devices have access to the bus, only one can transmit at any given time. The µP controls switching by turning devices on and off as necessary.

Audible Monitor

A separate analog signal is routed from the mux output to an audio amplifier (U64; MB/3-C2) via the front panel Volume control. This path provides a means of audibly monitoring the type of signal present on the line-under-test. It may be noted that a PCM signal in a DS0 channel is monitored by routing such signal to the receive DSP, then to the DAC via the serial bus, and finally to the receive path via the input mux (U1; AB). The key panel "beep" is generated by gating 1 kHz clock signal through a second op amp (U63; MB/3-C2), the output of which is also coupled to the speaker. Latch U24 (A6) provides a means of deactivating the amplifiers under software control.

Frequency Counter

Frequency is counted directly by the µP which counts the output from a zero-crossing detector (U31, 46; AB/2-B6). The detector is driven by a separate path starting with level selection (U4A), amplification (TP5), and frequency division (U31). The zero-crossing detector signals the µP that it has a valid state for frequency measurement via INT0—the highest interrupt level.

3.3.3 Test Generator

Test signals are generated in a DSP (U47; MB/1-A5) and then routed to the Digital to Analog Converter (U19; AB/2-D3) via the serial bus which is shared with the measurement DSP (U51). The two DSP devices can be used interchangeably for transmit signal generation or receive measurement—the function is determined solely in software. Ordinarily, the devices perform a specific function, as noted.

The DAC (U19; AB/2-D3) converts the 18-bit digital signal generated by the DSP to an analog form. The analog signal is constructed in a 4 kHz, 20 kHz, or 200 kHz LP filter (as determined by the bandwidth selected) to produce the final output. Level control is performed by a switched gain (20 dB) amplifier (U23) and a multiplying DAC (U24), which is used to provide precise and fine-grain level output. The sample and bit rates are a function of the selected frequency ranges, as shown in the following table.

Frequency	Sample Rate	Bit-rate
VF, 40–4k Hz	32 kHz	576 kb/s
Program, 40–20k Hz	95 kHz	1.7 Mb/s
Wideband, 20–200 kHz	715 Hz	12 Mb/s

The output test signal is then run through a line driver which has the source impedance selected by the operator. Finally, the signal is coupled to the balanced output circuit via a transformer. The output signal may also be routed to the transmit leg of a hybrid (used for Return Loss testing) and applied to the receiver for loop-back purposes.

3.4 DSP Measurement and Signal Generation

Digital Signal Processing is used to filter the input signal, detect level/phase, and perform signal analysis. All receive filters are constructed in DSP, using finite impulse response (FIR) transforms. DSP provides closer tolerance to design values, stable operation, requires no adjustments, and has high noise immunity. All signal detectors (RMS, average, peak, threshold) are implemented in software routines performed in DSP. Tone recognition/decoding, FFT, and other analysis is also part of the DSP process. In the 5200-17, a second DSP performs signal generation for the transmitter. This is an easier task than input signal processing and is used primarily to eliminate some expensive hardware which would otherwise be required to provide the high bandwidth.

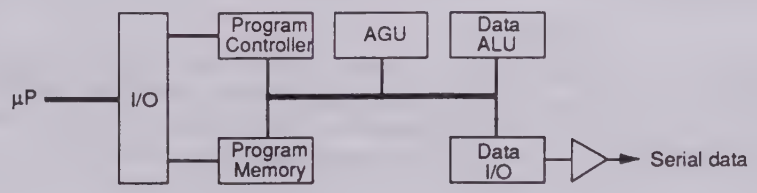


Figure 3-6: DSP

Figure 3-5 shows the basic blocks of the DSP device. The heart of the DSP chips are the three processing units, which are arranged to operate in parallel.

ALU: The arithmetic logic unit performs logical operations similar to those of any microprocessor. The primary difference is the use of multiple internal high speed busses between devices.

AGU: The address generator handles address storage and calculation.

Program Controller: This unit provides instruction prefetch and decoding, hardware control, and exception processing.

Program routines are loaded into memory and controlled internally by the program controller. External data interface is a serial bus which includes clock, frame and data rails.

3.5 Physical Description

The following drawings show the front and rear panels of the model 5200-17 test set. Features are described in the section which follows.

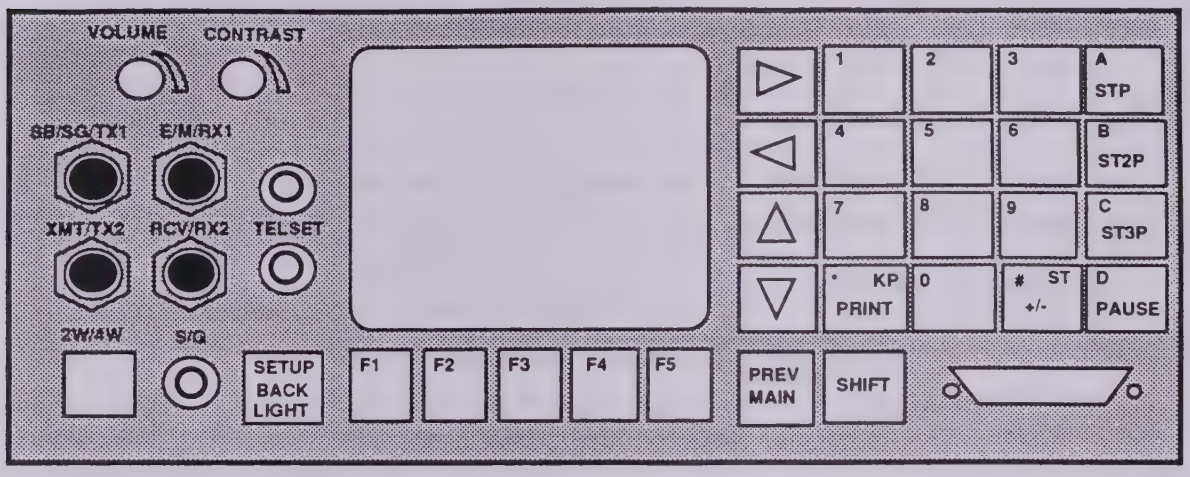


Figure 3-7: 5200-17 Front Panel

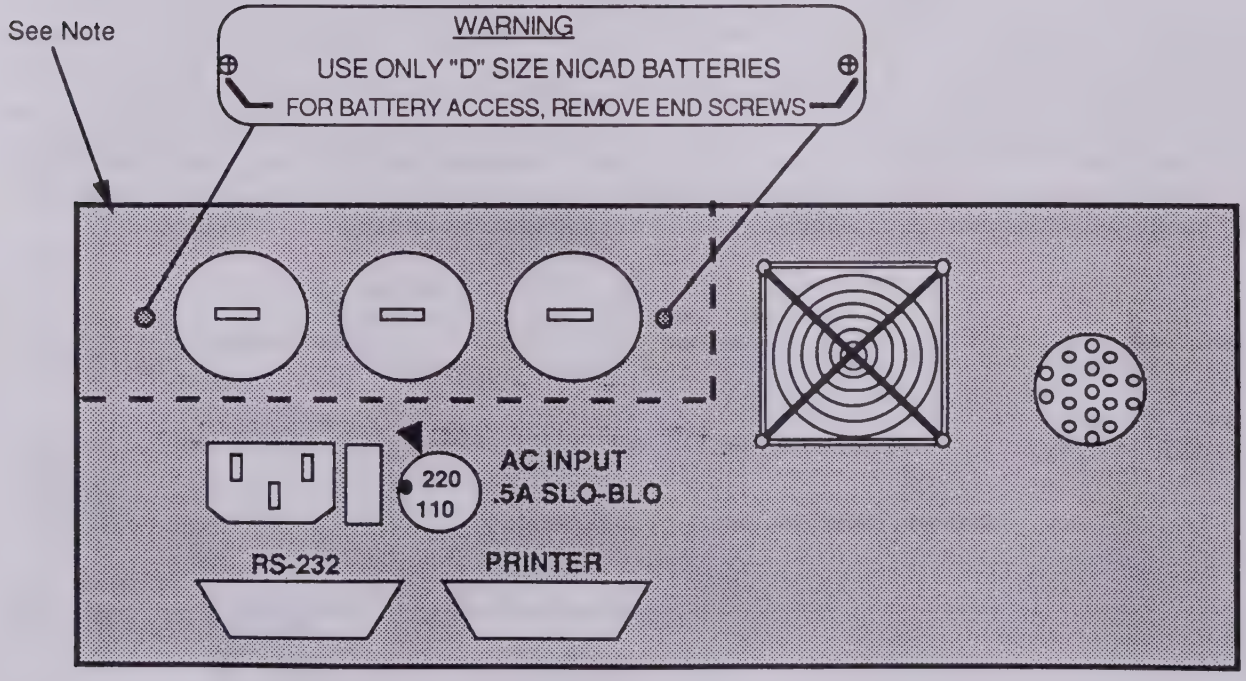


Figure 3-8: 5200-17 Rear Panel

This page intentionally left blank.

4. CONTROLS, INDICATORS AND FUNCTIONS

The 5200 Universal Transmission Analyzer is housed in a portable instrument case which can also be rack mounted. All operating controls are located on the front panel. Power, remote data link connections, printer connections, and the speaker are located on the rear panel. The battery compartment is also accessed from the rear panel.

The test set has no internal options or adjustments, and it should not be necessary to open the case in normal use.

4.1 Options

The MAIN screen shows any equipped options. These may be:

Option A: Signaling for loop-start, ground-start, DID, and E&M circuits. **(Not furnished with 5200-17 model.)**

Option B: TIMS, adds IMD, EDD, Jitter, and (transient) Hits to the basic measurement functions. **(Standard with 5200-17 model.)**

Option C: DS1 BERT and digital channel (DS0) testing. **(Not furnished with 5200-17 model.)**

This screen also shows the current date and time as maintained by the internal clock. These parameters may be adjusted from the UTILITIES function. (Test files record date/time, thus, it is important that both be correct.)

The version of software resident in the unit will also be listed on the main display.

4.2 Front Panel

The physical features of the front panel are described in the following table.

Item	Description
Mechanical Features	
VOLUME control and Power switch	Rotary control. Power is OFF when turned fully CCW. The initial display on power-up shows the version of software installed, as well as any equipped options. The speaker is used for audible monitoring of the channel under test. *Key-stroke audible feedback is provided by a separate arrangement which does not have a volume control but can be turned off from the* UTILITIES *function.*
CONTRAST	Adjusts the character/background contrast of the LCD display in order to compensate for differences in viewing angle.
BACKLIGHT (+SHIFT)	Combination (with the SHIFT) key which is used to toggle the display backlight ON/OFF.
Serial Data Port	RS-232C port which can be used for remote control or connecting peripheral equipment. Remote Control functions are not implemented at this time.

(table continued on next page)

Item	Description
Jacks	(Jacks are compatible with type 310 plug.)
Receive	Receiver input (4-wire operation).
Transmit	Transmitter output (4-wire operation) or 2-wire line connection.
SB/SG	Signaling battery/ground connections for use with some types of E&M circuits. SG lead is wired to TIP.
E/M	Trunk signaling interface. E-lead is wired to TIP.
TELSET binding posts	Connects external telephone directly to the (2-wire) line-under-test. Jack is cut off when any test is in progress.
LINE jack (RJ-11)	A 2 or 4-wire line may be connected to the test set via this modular connector. Wired in parallel with Receive and Transmit.
SG ground post	Chassis ground connection, also connected to the ground wire of AC plug. Must be connected to external ground for noise-to-ground tests when unit is powered from batteries.
Keys	
Fn (function keys)	The function of these keys is defined in software, with appropriate labels above the key. Test parameters are selected with these keys, which also control certain test set operations and display selections. Detailed screens are shown in the Operating Instructions.
SETUP	Shows the setup menu (configuration information) for the selected function. Each function (TIMS, SGNL, DS1, DS0), has a different set-up menu, and sometimes more than one.
PREV	Returns the set to the display shown previously. Up to 16 levels of backward movement are available.
MAIN (+ SHIFT)	Returns the test set to the main (start-up) menu. Any test which is in progress is stopped and results are not saved.
SHIFT	Used in conjunction with other keys to invoke an alternate control function. Shifted functions are marked in blue color on the front panel.
Cursor control (U/D, L/R)	Four-way control positions a cursor in selection or set-up menus. The cursor is a (>) symbol or a character underline (_).
Numeric keypad	Used to enter telephone numbers, frequency (Hz or kHz), level (dBm), or other numeric parameters.
PRINT (+ SHIFT)	Prints current test results on an external printer. If a printer is not attached, the message BUSY is shown briefly, printing operation is terminated and then normal operation is resumed.
+/– (+ SHIFT)	Used when entering a level. Toggles the entry from a normally (–) value to a (+) value.

4.3 Rear Panel

The rear panel features are described in the following table.

Item	Description
AC INPUT	AC power connector is designed for use with standard instrument power cord.
Voltage Selector	Switch selects 115/220 VAC mains power.
Fuse	0.5 Amp SLO-BLO fuse for 110 VAC operation.
Battery holder	Accepts 10 size-D NiCad rechargeable batteries. Use only 400 milliampere charge-rate batteries.
Speaker	May be used for audible monitoring of the line-under-test. Volume is set by control knob on front panel.
PRINTER	DB25 connector for parallel printer. Compatible with Epson type dot matrix graphic printers. *This is not an RS-232C port!*
Remote port	RS-232C DTE port designed for connection to an external data device. Not used at this time.

4.4 Display

The liquid-crystal display (LCD) provides 16 lines by 20 characters, or it may be used in a graphics mode. In the 5200, both modes are used simultaneously in some displays. The header (top two lines) will always display the test configuration—as appropriate for the selected function. The botton two lines are labels for the software-defined keys.

The center portion of the screen is used to show test results (in either numeric or graphic format), test menu selections, and operator messages.

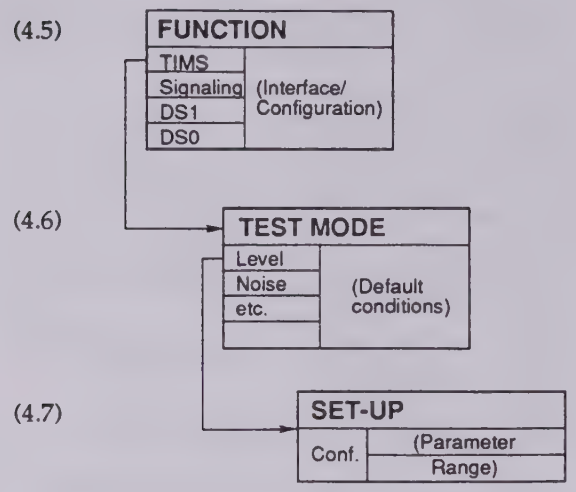
Operational Messages

The following messages indicate that special conditions exist, such as alarms, unusual generator condition, interface configuration, etc.

LOW BAT:	Battery voltage has dropped to a low level. Operation will cease in 10 minutes.
PRT ON:	Print function is active. No measurement can be made while printing.
SF SKIP	This message may be preempted by other messages.

4.5 Functions

The test functions of the model 5200-17 are described in this section. Figure 4-1 illustrates the interrelationship of different parts of this material.



Functions are selected by soft-keys on the MAIN screen. The table describes each function, and lists the interface or configuration provided.

Each Function has an associated test (mode) selection menu. TIMS test selections are described in section 4.6. Default values are shown for each test.

Each test (mode) selection has a unique list of test parameters and default conditions. In some cases, the parameter listing changes when the first item (interface) is changed. Test parameters are set in the SET-UP menu.

Figure 4-1: Description sequence

The function of the test set is determined by pressing the appropriate softkey on the MAIN menu. (In its basic configuration, the 5200-17 offers only three functions: TMS, Dial, and Utility.) These functions are briefly described in the following table, which also shows the distinct configurations available for each function. The test set configuration is established when the type of Interface is selected from the SET-UP menu.

Function	Description	Configuration
TIMS	Set is configured to measure an analog signal and to generate a test signal. Test capability includes all VF or wideband measurements equipped, as described in the section 5.6.	VF/4-wire; VF/2-wire; Program; Wideband
SIGNL (option)	Set is configured to test signaling parameters of a metallic VF circuit. Limited VF measurement capability is directly accessible. All analog test capability is available indirectly.	Loop-start; Ground-start; DID; E&M
DS1 (option)	Set is configured to test a single or dual digital (DS1) line. Facility monitoring, DS1 BERT, and SLC monitoring is provided.	Monitor; BERT; Alarm Monitor; Pulse Quality
DS0 (future option)	Set is configured to gain access to DS0 channels from the dual digital (DS1) interfaces. Any channel can be accessed for two-way testing (drop and insert operation). Signaling, BERT, and VF measurements are available.	Monitor; Terminate; Drop/Insert
UTLY	Main Menu Utilities provides housekeeping functions which do not pertain to any specific test selection, such as: setting the clock and enable/disable the keyboard beep. Utilities within individual functions allow recalling of stored test results, return to default settings, and self-test routines.	**Main Menu:** Clock; Keyboard beep **Individ. Functions:** Recall Test Results; Defaults: Selftest

4.6 Test Selections-TIMS

Each Function has a number of test (mode) selections available. The following test selections are available when the TIMS function has been selected.Parameter selections are detailed in section 4.7.

TIMS Test Functions

Test	Description	Defaults
LEVEL/ FREQ. (Level and Frequency)	The transmitter generates a single frequency tone in the range 40 Hz to 200 kHz at a level ranging from -40 to +13 dBm. The receiver has a flat response covering the entire frequency range and will measure both the frequency and the level of any tone present using an averaging detector.	VF/4W: 600 Ω; Tx: 0 dBm, 1004 Hz; SF Skip: OFF; Loopback: 2713; TERM; TLP: 0 dB.
3-TONE SLOPE	The transmitter generates three frequencies, 1004, 404, 2804 Hz, in sequence under control of STEP key. The receiver measures level at the same three frequencies and displays the value in dBm. If the SET REFERENCE key is operated, the level measured at that point is displayed as 0 dB and other levels are shown as a deviation from this reference level; i.e., +1.4 dB means that the tone level is 1.4 dB higher than the reference level. Applicable to VF range only.	VF/4W; 600 Ω; Tx: 0 dBm; Loopback: 2713; TERM; TLP: 0 dB.
AMP. RESP (Amplitude Response)	The transmitter generates a series of test frequencies, as selected from the Test Set-up menu. Items include frequency range, step size, and sweep rate. The receiver measures level and frequency and displays results in either tabular or graphic form. Level is measured in dBm, dBm0, or as distortion (± dB)with respect to a reference level.	Same as Slope plus: 304–3804 Hz range, 100 dB steps, C1; MED sweep rate SINGLE sweep
P/AR (Peak to average ratio)	Generates and measures the P/AR signal. VF range only.	Same as Slope
Noise	Noise-with-tone, idle-line noise, or noise-to-ground (in 2W only) may be measured. The transmitter is set to 1004 Hz or quiet. The received signal is filtered and measured with an RMS detector. Filter selection depends on selected bandwidth.	VF/4W; 600 Ω; Tx: 0 dBm; Loopback: 2713; TERM; TLP: 0 dB.
RTN LOSS (Return Loss)	Generates and measures ERL, SRL-Low, and SRL-High signals, as well as single tone RL. VF/2- or 4-wire; compensated for THL and received level may be corrected for transmission loss with a SET REF key.	VF/4W; 600 Ω; Tx: –10 dBm
IMP NOISE (Impulse Noise)	The transmitter is set at 1004 Hz or quiet termination. The receiver inserts a weighted filter and notches out test tone (if present).Energy peaks which exceed a set threshold are counted as impulses.	VF/4W; 600 Ω; Tx: 0 dBm; Loopback: 2713; TERM; TLP 0 dB.

(table continued on next page)

TIMS Test Functions (Continued)

Test	Description	Defaults
IMD (Inter-modulation Distortion)	The transmitter generates a 4-tone or 2-tone signal alternately, with approximately 4" for each. The receiver measures intermodulation (A±B and 2A-B) and noise products in three bands while 4-tones are detected and noise products alone while 2-tone are present. Both the (Distortion + Noise) and corrected (distortion alone) values are displayed simultaneously. VF range only.	VF/4W; 600 Ω; Tx: 0 dBm; Loopback: 2713; TERM; TLP: 0 dB.
IMP/HITS (Impulse Noise/Hits)	The transmitter is set at 1004 Hz, or quiet for idle line noise measurements. The receiver notches out the tone, filters the energy in the pass band, applies set level/phase/amplitude thresholds and counts crossings per the standard. All ranges.	VF/4W; 600 Ω; Tx: 0 dBm; 1004 Hz; LB=2713; TERM; TLP 0 dB; 67 dBrnC; 4 dB; 8 pps; 15 min; Gain=3 dB; Phase=20°
ENV DELAY (Envelope Delay Distortion)	Transmitter produces a phase modulated swept frequency carrier signal (return reference). The far-end unit strips off the modulation envelope and superimposes it on a fixed carrier which is transmitted back to the master unit. Phase variations of the received modulation envelope are measured. May also be configured to send fixed/receive swept carriers (forward reference). VF range only.	Master; 600 Ω; Tx: 0 dBm; 304–3204 Hz, 100 Hz steps, C1 mask; MED, single swp; TERM; TLP 0 dB.
PHS/AMP JTR (Jitter Phase/Amp)	Transmitter set for 1004 Hz. Receiver measures filtered phase and amplitude jitter in two bands. VF range only.	VF/4W; 600 Ω; Tx: 0 dBm; LB=2713; TERM; TLP 0 dB.

4.7 TMS/TIMS Parameter Selections

Some TMS test functions have a secondary set-up menu which is used to select certain test operational parameters. The menu which lists these parameters is identified with a unique descriptive term but here is identified by the generic term *test set-up*.. The following tables outline the test parameter selections.

Swept Frequency Test Parameters

The set-up parameters for analog Level testing are as shown. These parameters are applicable for Level/Frequency, Slope, and Amplitude Response.

Interface	VF/2w	VF/4w	Program	Wideband
Freq. Range (Hz)	40–5000	40–5000	40–20k	0.1k–200k
Step size (Hz)	1, 10, 100	1, 10, 100	250, 1k	2.5k, 10k
Tx Level (dBm)	-40 to +13	-40 to +13	-40 to +13	-40 to +13
Impedance (Ω)	600, 900, 150, 1200	600, 900	150, 600, 900	135
Rcv. TLP (dB)	-16 to +16	-16 to +16	-16 to +16	-16 to +16
SF Skip	Off/On	Off/On	-	-
LB Freq. (Hz)	-	2713, 2863, user selected	-	-

Noise Test Parameters

The set-up parameters for analog Noise testing are as shown.

Interface	VF/2w	VF/4w	Program	Wideband
Mode	Balanced NTG [1]	Balanced	Balanced	Balanced
Filter [1]	C-message 3k Hz Flat, Notch	C-message 3k Hz Flat, Notch	Program 15 kHz	50 kbit
Tx Level [2](dBm)	-40 to +13	-40 to +13	-40 to +13	-40 to +13
Impedance (Ω)	600, 900, 150, 1200	600, 900	150, 600, 900	135
Rcv. TLP (dB)	-16 to +16	-16 to +16	-	-
LB Freq. (Hz)	-	2713, 2863, selected	-	-

1. Soft-key control.
2. Transmitter may be set to QUIET termination with soft-key.

Impulse Noise/Transients Test Parameters

The set-up parameters for analog Impulse noise and Transient testing are as shown.

Interface	VF/2w	VF/4w	Program	Wideband
Filter (preselected)	C-message	C-message	Program	50 kbit
Threshold (dBrn)	30–110	30–110	30–110	30–110
Test Time (sec.)	1–999	1–999	1–999	1–999
Counts/second	8, >99	8, >99	8, >99	8, >99
Phase Thres. (°)	5–45	5–45	-	-
Gain Thres. (dB)	2–10	2–10	-	-
Tx Level [2](dBm)	-40 to +13	-40 to +13	-40 to +13	-40 to +13
Impedance [1] (Ω)	600, 900, 150, 1200	600, 900	150, 600, 900	135
Rcv. TLP (dB)	-16 to +13	-16 to +13	-	-
LB Freq. (Hz)	-	2713, 2863, selected	-	-

1. For 4-wire VF interface, impedance may be selected separately for Transmit and Receive.
2. Transmitter may be set to QUIET termination with soft-key.

Envelope Delay Test Parameters

The set-up parameters for Envelope Delay Distortion are as shown.

Interface	VF/4w-Measure		VF/4w-Repeat	
Reference Line	Forward	Return	Forward	Return
Freq. Range (Hz)	1804	304–3404	304–3404	1804
Tx Level (dBm)	-40 to +13	-40 to +13	-40 to +13	-40 to +13
Impedance (Ω)	600, 900	600, 900	600, 900	600, 900
Rcv. TLP (dB)	-16 to +16	-16 to +16	-16 to +16	-16 to +16
SF Skip	-	Off/On	Off/On	-
Sweep Control	-	Start/Stop, Step size, Rate	Start/Stop, Step size, Rate	-
Step size (Hz)	-	1, 10, 100	1, 10, 100	-
Display	EDD, Amp Dist	Numerical/graph	Level/Frequency	Level/Frequency

4.8 Utilities

Utilities are accessed in two ways: from the Main Menu for utilities that relate to the overall 5200-17; and from the Selection Menu of each individual function for utilities that relate specifically to that function. For example, Date/Time is available in the main utility, while Results Files are available within the individual function (TIMS, DS1, Signaling)

Main Menu Utilities	**Description**
Date/Time	Sets date and time values of real-time clock.
Keyboard Beep	Turns audible key-panel feedback generator ON or OFF.
Configure Remote Port	Remote control is not implemented at this time.
Function Utilities	**(TIMS)**
Results Files	Provides access to stored test data. Up to 20 files may be stored.
Defaults	Resets all default values for that function to factory settings.
Self Test	Initiates a test of memory, test and measurement circuitry, and key-panel operation. All stored test files and telephone numbers will be erased in the process, and parameter selections will be set to factory default values.

4.9 Dial Functions

The following features are available when the DIAL function has been selected.

Function	**Description**
On/Off hook	Controls holding circuit attached to Transmit jack appearance.
Last Number Redial	Recalls the last dialing sequence.
Recall List	Presents a list of up to 5 telephone numbers for automated access of test lines or for addition of another number. Three separate lists, for DP, DTMF, and MF, are provided.
Level/Frequency	Initiates a VF/2W test of Level/Frequency.
Noise	Initiates a VF/2W test of Noise.
Next Test	Provides access to the regular TMS/TIMS Test Selection menu.

4.10 TIMS Software-Defined Operational Keys

Keys which provide a test set operation are described in the table. Parameter selection keys or display manipulation keys are not listed—see appropriate Operation section of manual.

Key label (TMS)	Description
AMP JIT/PHS JIT	Toggles jitter measurement configuration to measure amplitude or phase jitter.
EXIT	Returns set to the Main menu
ENTER	Exits the transmitter level/frequency adjustment mode during a test.
LEV-FREQ	Initiates Level measurement from DIAL mode.
LOOP-UP LOOP-DOWN	Transmits the VF loop-back tone (2713 Hz, or as selected in set-up menu) for 5 seconds, or until loop condition is detected. Key label toggles.
NEXT TEST	Returns set to test (mode) selection menu for that function.
NOISE	Initiates Noise measurement from DIAL mode.
NTG/BAL	Toggles noise measurement configuration to measure noise-to-ground or balanced circuit noise. (2W mode only)
NOTCH/QUIET	Toggles transmitter from tone to quiet termination in noise measurement mode.
RCL LIST	Displays list of stored telephone numbers.
SAVE	Test results are saved to a file which is automatically identified by test name, time and date. Test files may be viewed from the UTILITIES function.
SELECT	Accepts the selection marked and steps the set to the next operation, i.e., starts the test and displays the results screen.
SEND/MEAS	Toggles 2-wire line to transmitter/receiver. (2W mode only)
SET 0 REF	Applies a correction to the measured value such that the display will read 0 when that value is received.
MF/DTMF DIAL	Allows direct dialing of MF/DTMF digits on 2 or 4-wire dry circuits.
SET THL	Applies a correction to return loss measurement to compensate for THL and circuit loss. A complete reflection will be displayed as 0 dB return loss.
SWEPT/STD	Toggles return loss configuration to measure structural return loss (RL at each frequency) or weighted return loss.
STOP/START	Stops impulse/transient count test, or restarts same test.
RET REF/FORW REF	Toggles between return reference mode (sending sweep) and forward reference mode (sending reference tone) in envelope delay test.
TX ON/TX OFF	Toggles transmitter between tone/quiet during level/frequency.

5. GENERAL OPERATION OF THE 5200-17

5.1 Basic Operation

This section describes the general operating procedure for the 5200-17. Once this procedure is understood, very little difficulty should be encountered in using all of the many features of the test set.

Figure 5-1 shows the basic operating sequence in graphic form. The 5200-17 is controlled by a combination of dedicated keys (front panel) and software-defined keys which are identified on the screen when active. In the figure, the oval symbols represent front-panel keys. The label of the soft-key (which advances the operation to the next stage) is shown below each menu.

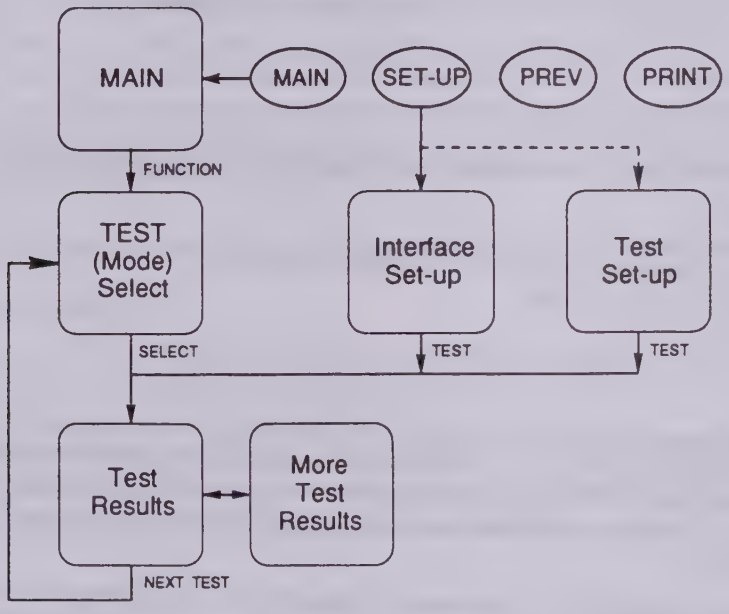


Figure 5-1: General Operating Procedure for the 5200-17

Test Set Control

Operation of the 5200-17 (start test, change test, page display, etc.) is controlled by software-defined keys. The primary exception to this is gaining access to the SETUP menus, which are made available by means of a dedicated key on the front panel. Other front panel keys include cursor control (arrow) keys which are used for scrolling and the PRINT key which causes the test results to be printed to an external device. Control functions of the set may be categorized as follows:

Parameter Selection: Test parameter choices for a line item in the setup menu are listed on softkeys when that item is marked by the cursor. If more than five items are in the list, a MORE key provides paging to the next group. The list wraps back to the beginning when the end is reached. Some selections, consisting of numeric data, may be entered directly into the field from the keypad.

Display Paging: Softkeys are provided for the purpose of viewing additional test results, if necessary. Test results are typically put in logical groupings if they are too voluminous for showing on the primary results page. These are generally self explanatory and require little knowledge of specific terminology.

Test Control: Control keys serve to step the test process along in an orderly fashion in some modes. The control sequence will have to be understood, at least in rudimentary terms, in order to use the test set effectively. The Operation sections include a simplified menu map which puts the process in perspective.

5.2 Function

The Model 5200-17 is a complete wide band TIMS test set. All available tests (modes) are then listed in the primary menu for that function. Test parameter selections are listed in the SETUP menus.

The start-up (Main) display shows equipped functions in the form of soft-keys. A UTILITY function is also provided for general operations, such as setting the clock and self test. *The test set is not performing any testing function when the main menu is being displayed.* Operation of the MAIN key at any time will abort a test in progress and results for that test will be lost.

5.3 Operating Steps

Once a Function has been selected, the following steps should be followed in sequence:

- Set up the interface.
- Select the test (or mode).
- Set up the test. In some cases, this is not a separate operation.
- Start the test (SELECT or TEST key)
- Evaluate the results.

Interface Setup

Once a basic function has been selected, the interface parameters of the test set can be set to match the characteristics of the line-under-test. The setup menu is available at any time (after a function has been selected) by using the SETUP key located on the front panel). The items listed in the setup menu are those which are appropriate for the basic interface arrangement, thus, will be different for different interface selections.

The last valid interface setup is shown in the header of all displays. It is, however, good practice to examine the setup menu itself when first starting a test session to ensure that *all* settings are correct.

Test (Mode) Selection

Each basic test function can be configured for a number of different modes, i.e., TMS is divided into Level and Frequency, Noise, etc. The appropriate test selection (mode) menu is displayed when a function is selected from the Main menu. This is the primary selection menu for a particular function and can always be recalled from deeper levels with the NEXT TEST key. Note that operation of the NEXT TEST key will terminate a test in progress.

The mode menu has a SELECT key which will start the selected test and display test results. For some tests, control keys are made available to loop back the distant end of the network channel before testing takes place. A test can also be started from any setup menu with the TEST softkey.

Test Setup

Some tests have unique variables which may have to be adjusted prior to the test in order to obtain the desired results. These tests include Amplitude Response, Impulse Noise, Impulse Noise/Hits, and EDD. When such a test is selected, the SETUP key brings up a unique Test Setup menu first, then acts as a toggle between this and the Interface Setup menu. Since test variables are *not* displayed in the results screens, it is important to be aware that such a menu exists.

Test Results Display

The display will automatically show the test results when the test is started. The format of the results page is unique to the particular test being executed but the following provides an overview.

The top two lines are reserved for showing the configuration of the interface and/or the test conditions. The lower two lines always show the labels for the keys located below the display—which are defined in software and provide functions appropriate for the test being executed. Status messages, frequently in cryptic form, will be shown on the line just above the softkey labels.

Measured data is shown in the main portion of the display, and in some cases, the transmitter output signal is also shown. Variable test parameters (such as frequency) may be changed directly from the test display by positioning the cursor (underline) with the L/R control keys to mark the digit, then incrementing or decrementing the value by using the UP/DN cursor control keys. They may also be changed by entering the value from key pad and pressing 'ENTER' to terminate the entry.

Displays, and the use of specific control keys, are described in detail in the Operation sections.

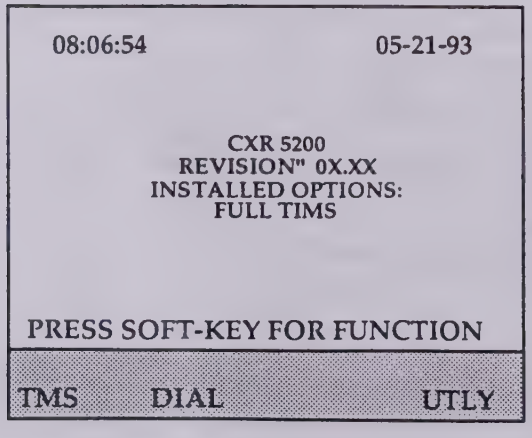
Operating Condition Indicators

Messages indicate that special conditions exist, including alarms, unusual generator condition, interface configuration, etc. These include the following:

LOW BAT:	Battery voltage has dropped to a low level. Operation will cease in 10 minutes.
PRT ON:	Print function is active. No measurement can be made while printing.
SF SKIP:	This message may be preempted by other messages.

5.4 Main Screen

The MAIN screen is displayed after the power-up process completes, or whenever the MAIN key is operated. The 5200-17 is not performing any test function when this screen is displayed.



MAIN screen
This is the only display which shows the time and date. Equipped options are listed, and the software revision installed in the set is shown.

Select the test function from this screen by operating the appropriate softkey. Softkeys are shown for equipped options only.

Use the UTILITY function to reset the time/date and set up housekeeping functions.

This page intentionally left blank.

6. OPERATION-TMS/TIMS

The menu map shown in figure 6-1 illustrates the operation of the TMS function. The direction arrows show the exits from a particular menu or the control input which causes that menu to be shown. Control signals are initiated by front panel keys (oval symbol) or by soft-keys which are created by software as necessary. (The dashed windows show example screens.)

Setup Menus

Setup menus are available at any time after the TMS/TIMS function has been selected from the MAIN screen. Access to the setup menus is provided by means of a dedicated front panel key. The specific menu which is presented depends on which test is selected. Some test selections may provide up to three pages of setup menus, as follows:

- **INTERFACE SETUP:** Lists test set interface parameters.
- **TEST SET-UP:** Lists items pertaining to the operation of a specific test.
- **USER SELECTION:** When a "user specified" selection is made, the Test Set up menu is modified to reflect items which are relevant to that state only.

For tests with multiple pages in the setup menu, the Test Setup page is shown first when the SETUP key is operated. The primary (Interface) menu is shown when the SETUP key is operated a second time. Tests which have a secondary menu include: Amplitude Response, Impulse noise/Hits, and EDD. The third page (if provided) is in effect a modified Test menu which is activated by means of a softkey.

Test Operation

The selected test can be started from any Set-up menu, or from the Test Selection menu itself. The format of the Test Results display varies with the nature of the test. The procedures described show most variations, however, some minor differences from actual operation may be encountered.

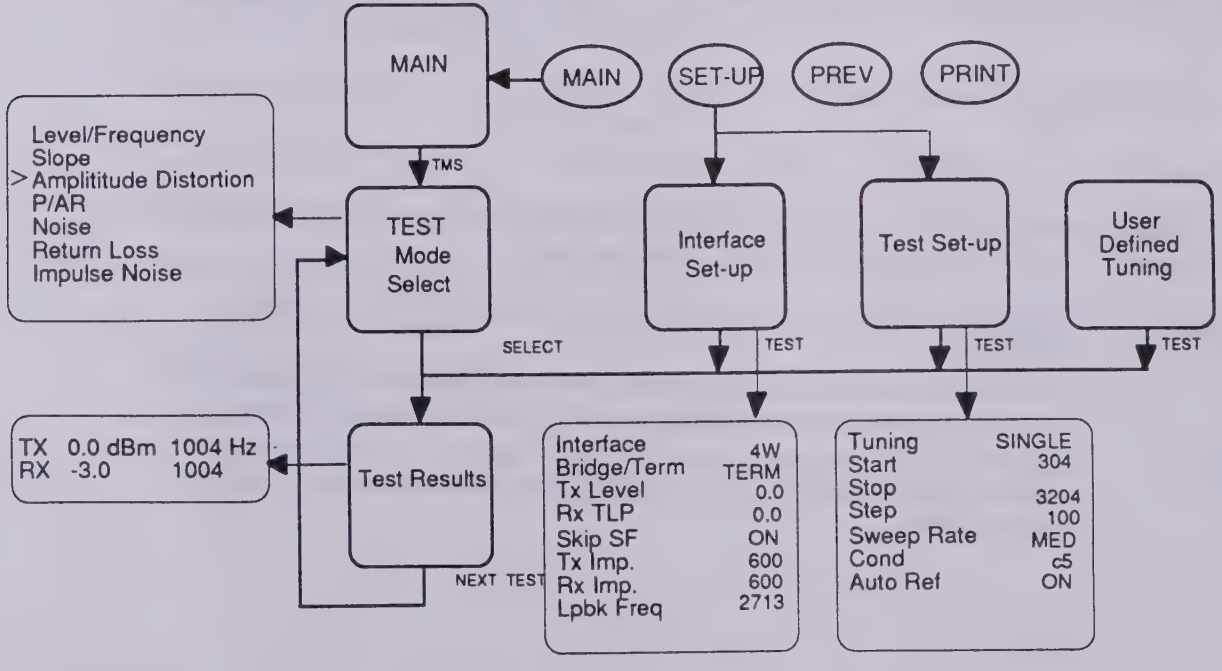
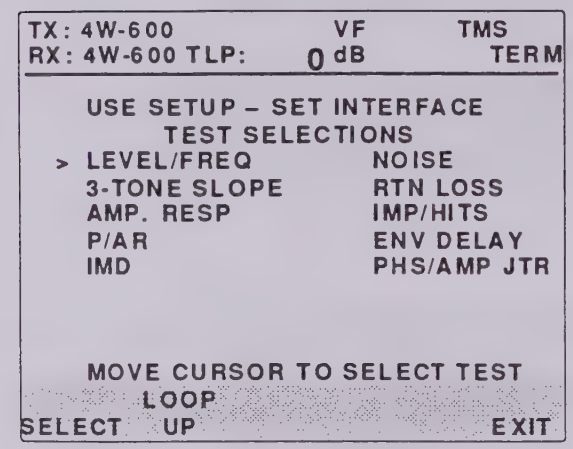


Figure 6-1: Menu Map for TMS Function

6.1 Test (Mode) Selection

The Test Selection menu shown below is displayed when the TIMS key on the Main screen is operated or when a NEXT TEST key on any Test Results screen is operated. This is the primary (first level) menu for the TIMS function. The general operating procedure is:

- Verify the line interface settings (from Header and/or Interface Set-up menu)
- Select a test (verify Test Set-up, if necessary)
- Read the results
- Return to this menu for the next test selection.



Test selection menu (TIMS):

Header shows configuration, as selected in Interface Set-up menu (VF/4W). Line impedance (600/600), TLP (0 dB), receiver termination (ON), and selected function (TMS) are also shown.

The SET-UP key will bring up the Interface Set-up menu when this test is selected.

Use cursor control (arrow) keys to position (>) marker opposite test to be selected.

Display Variations

If option B (TIMS) is not equipped, IMD, Env. Delay, and Jitter are not listed; Impulse Noise/Hits is Impulse Noise only. Variations for other interface selections are:

2-wire interface:	LOOPBACK control is not provided; Envelope Delay is listed. but not selectable.
Program:	LOOPBACK control is not provided; 2-wire only; test selections consist of Level/Frequency, Amplitude Response, Noise, and Impulse Noise.
Wideband:	LOOPBACK control is not provided; 4-wire only; impedance fixed at 135 Ω; test selections include Level/Frequency, Amplitude Response, Noise, and Impulse Noise.

Control Keys

SELECT	Starts test. Display automatically changes to Test Results screen.
LOOP UP/DOWN	(VF/4-wire only) Initiates transmission of the loop control frequency selected in the Interface Setup menu. Not provided for all tests.
EXIT	Returns the set to the Main menu.

Procedure

(1) Select TMS/TIMS from the Main screen. The menu listing for TIMS is shown on the previous page.

(2) Verify the line interface settings displayed in the header. If changes are necessary, operate the SETUP key on the front panel and adjust as required. (Section 5.2 shows selectable items.)

To return to the Test Selection menu (from any Setup menu), operate TEST on that menu, then NEXT TEST on the Test Results display.

(3) Select the test using the cursor control (arrow) keys. If the test selected has a secondary setup menu, operate SETUP to verify settings.

(4) Connect the test set to the line to be tested. Section 2.4 shows basic connections.

(5) If the test is to be made on a round-robin basis (VF/4-wire only), operate the LOOP-UP key and observe the operator messages which follow. The transmitter will generate the pre-selected tone (for as long as 5 seconds) until the receiver detects the returning tone following successful loopback. Messages include:

SENDING LOOP UP	continues for 5–7 seconds, or until loopback tone is detected
LOOP UP COMPLETE	Soft-key label changes to LOOP DOWN
LOOP UP FAILED	aborts procedure

(6) Operate the SELECT key to start the test. Results are displayed.

SENDING LOOP DOWN	continues for 5–7 seconds, or until loopdown is complete
LOOP DOWN COMPLETE	service is restored
LOOP DOWN FAILED	failed to restore service

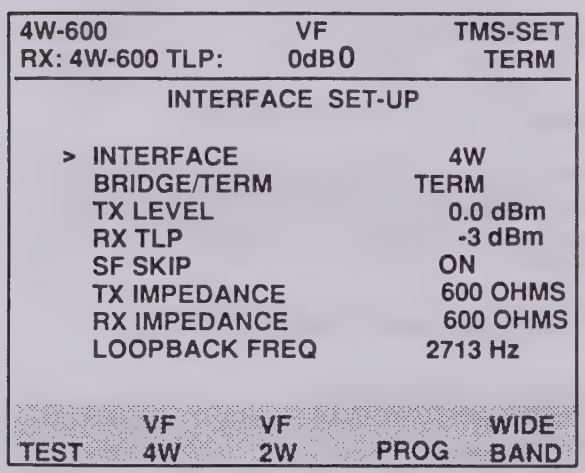
6.2 Interface Setup

The Interface Setup menu provides a means of matching the test set interface to the characteristics of the line to be tested. This menu is accessed directly by means of the SET-UP key located on the front panel.

> ***A test in progress is stopped when the set-up screen is displayed. A warning message will be displayed.***

When a test mode which has a separate Test Setup menu is active (Amplitude Response, Impulse Noise, or Envelop Delay Distortion), the secondary menu is shown first. The SETUP key will act as a toggle between the two setup menus. The TEST key on any menu provides an exit from the setup condition. Alternatively, the PREV key can also be used to back up to any screen shown previously in the procedure. Up to 16 past screens in the sequence can be recalled.

The type of metallic interface (2W/4W/Program/Wideband) determines the frequency range of the set and which items are listed in the Setup menu. Accordingly, the first item (INTERFACE) should always be set first. The screen shown below lists the default selections for a VF/4W interface. The description details the variations in the listings with the type of interface which has been selected.



Interface Set-up menu
Configuration: Header shows present interface selection.

Use cursor keys to position (>) marker opposite item to be changed.

Parameter selections appear on soft-keys; numeric values are entered from keypad.

Interface Variations

See table on following page for applicable selections.

Control Keys

TEST Starts the test which is indicated by the > marker.

PREV (On front panel). Steps the display back to the previous screen.

Parameters

Menu item	Interface	Selections	Notes
Interface	General	2W-VF, **4W-VF,** PROGRAM, WIDEBAND	Items which follow vary with type of interface selected.
Termination	All	TERM/BRIDGE	
Transmit level	All	-40 to +13 dBm (**0**)	
Receive TLP	All	-16 to +16 dB (**0.0**)	TLP applies only to VF circuits.
Transmit impedance	2W	150, 600, **900**, 1200 Ω	
	4W	**600**, 900 Ω	
	Program	150, **600**, 900 Ω	
	Wideband	135 Ω	
Receive impedance	4W	150, **600**, 900, 1200 Ω.	Separate selection for 4W only.
SF skip	VF	On/off	
Loopback frequency	4W	**2713**, 2863, keypad entry	

Defaults are shown in bold.

Procedure

(1) With TMS as the selected Function, operate the SET-UP key located on the front panel. If a Test Set-up menu appears, operate the key a second time to access the Interface Set-up menu.

(2) Select the INTERFACE parameter first. This selection determine which items follow on the menu.

(3) Verify all selections and adjust as necessary. Applicable parameter values are listed as soft-keys; or the keypad may be used to input numeric values directly.

(4) The SET-UP key may be used to toggle back to the Test Set-up menu, if necessary.

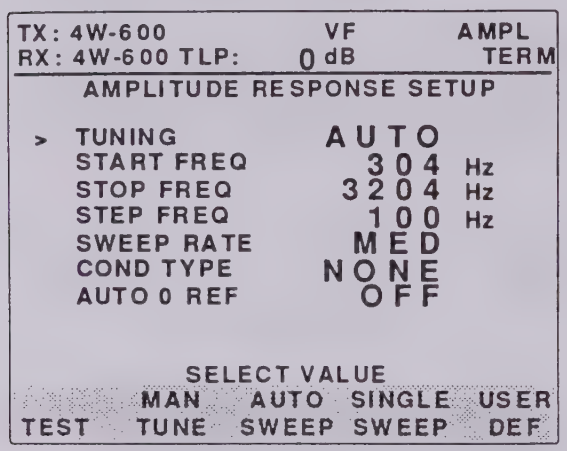
(5) Operate the TEST key to exit the Set-up menu and start the test.

6.3 Test Setup Menus

Certain test selections have a secondary setup menu which lists those items pertaining to the conduct of that particular test. When such a menu is provided, it will always be shown first when the SETUP key is operated. If the SETUP key is pressed again, the Interface Setup menu will be shown. The SETUP key then acts as a toggle between the two setup menus. The TEST softkey provides an exit from the setup state.

6.3.1. Amplitude Response Test Menu

The Amplitude Response Setup menu provides a way of controlling the frequency range and rate of the sweep. The conditioning mask (used in the graphic display of test results) may also be selected. The following illustration shows the menu for a 4W interface . Variations are listed in the table.


TX: 4W-600 VF AMPL
RX: 4W-600 TLP: 0 dB TERM
AMPLITUDE RESPONSE SETUP
> TUNING AUTO
START FREQ 304 Hz
STOP FREQ 3204 Hz
STEP FREQ 100 Hz
SWEEP RATE MED
COND TYPE NONE
AUTO 0 REF OFF
SELECT VALUE
TEST MAN TUNE AUTO SWEEP SINGLE SWEEP USER DEF

Amplitude Response Test Set-Up Menu
Use arrow keys to position (>) marker opposite item to be changed. See following table for item list.

Parameter selections appear on soft-keys; numeric values are entered from keypad.

TEST advances to the test selection menu. (Operating the select key starts the selected test.)

PREV key (on front panel) returns set to the last previously shown display.

Test Parameters

	VF	PROGRAM	WIDEBAND
Tuning:	MANUAL, AUTO, SINGLE, USER DEF (6 selected tones)		
Sweep rate	SLOW, MED, FAST (Auto, single sweep only)		
Start (Hz)	40–3404; **304**	0.100–20k; **0.100**	0.100–200k; **20k**
Stop (Hz)	40–3404; **3404**	0.100–20k; **20k**	0.100–200k; **200k**
Step (Hz)	10–1000; **100**	0.100–1k; **1k**	0.100–10k; **1k**
Conditioning mask	3002, **C1**–C6, D6, OFF	NA	NA
Auto 0 Reference	On, **Off**	NA	NA
Loop Device	**NRML**, 4003C	NA	NA

Note: Defaults for Auto and Single sweep shown in bold. Items marked as NA do not appear in listing.

Explanation of Terms:

Tuning: Selects the method of controlling the transmitter frequency during the test. If MAN or USER DEF is selected, the front panel UP/DOWN cursors are used for manually scrolling the transmit test tones up and down.

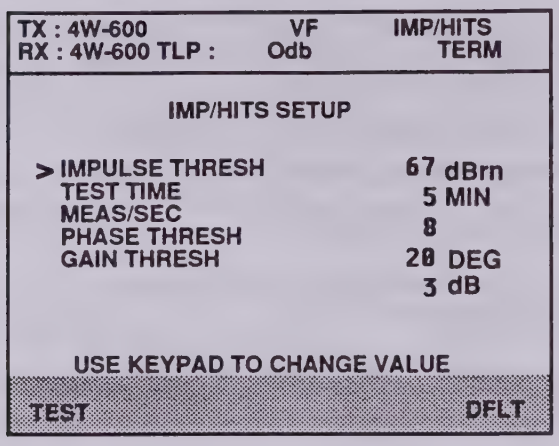
Sweep Rate: Three sweep speeds are provided: FAST: 3.5 secs; MEDIUM: 5 secs; SLOW: 10 secs.

Conditioning Type: Eight conditioning masks are available to automatically check compliance with circuit specifications. Level must be referenced to "0" in order to check Attenuation Distortion.

Auto 0 Ref: When On, the receiver automatically sets a "0 dB" reference at 1004 Hz. Default setting is OFF.

6.3.2 Impulse Noise Test Menu

Test parameters unique to the Impulse Noise/Transients test are itemized in a secondary Test Set-up menu. This menu will vary according to the configuration of the 5200 and the interface selected. Basic TMS versions of the 5200 provide only Impulse Noise, not transients; therefore no phase or gain thresholds can be set. Transients measurement is provided with Option B, full TIMS. However, transients measurements are blocked when Program or Wideband is selected as the interface.



Impulse/Transient test set-up menu
Use arrow keys to position (>) marker opposite item to be changed. See table below for selection list.

Parameter selections appear on soft-keys; numeric values are entered from keypad.

TEST starts the selected test.

PREV key (on front panel) exits to the last display shown.

DFLT restores factory setting for that parameter.

Test Parameters

	VF	PROGRAM/WIDEBAND
Impulse thresh. (dBrn)	30–110; **67**	**44**, 47, 55, 58
Phase threshold (°)	5–45; **20**	NA
Gain threshold (dB)	2–10; **3**	NA
Count rate (pps)	**8 pps**, >99 pps	
Test time (min)	1–999; **15**	

Defaults shown in bold.

Explanation of Terms

Impulse Threshold: Sets the first threshold level, in dBrn. Any impulse which crosses this threshold will be counted by the first register. The second threshold is automatically set 4 dB higher; the third threshold 8 dB higher.

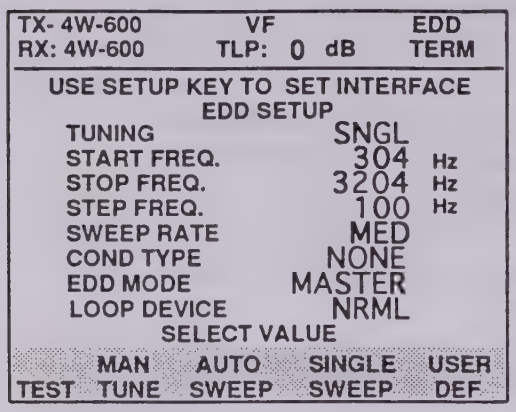
Count Rate: Impulses may be counted at the traditional rate of 8 pps, or without any blanking. The VF channel limited rate is approximately 100 pps.

Phase Threshold: The phase jitter threshold may be set in 5° increments. Excursions in phase of the 1004 Hz test tone which exceed the set value will be counted.

Gain Threshold: The gain hit threshold may be set in 1 dB increments. Rapid changes in signal level will be counted as gain hits if such changes exceed the set threshold.

6.3.3 Envelope Delay Distortion Test Menu

Envelope Delay Distortion is available only when the 5200 is equipped with Option B, full TIMS, and only when 4-wire is selected as the interface type. The test parameters are virtually identical to those listed for Amplitude Response, except that the 5200 can be configured as a MASTER (measuring) unit or as a SLAVE (repeat unit).



Envelope Delay Distortion test menu
Use arrow keys to position (>) marker opposite item to be changed.

Parameter selections appear on soft-keys; numeric values are entered from keypad.

TEST starts the selected test.

PREV key (on front panel) exits to the last display shown.

Test Parameters

Tuning:	MANUAL, AUTO, SINGLE, USER DEF	USER DEF consists of 6 selected tones
Sweep rate	SLOW, MED, FAST	Auto, single sweep only
Start (Hz)	40–3404; **304**	
Stop (Hz)	40–3404; **3404**	
Step (Hz)	10–1000; **100**	
Conditioning mask	3002, C1–C6, D6, OFF	
EDD mode	MASTER, SLAVE	
Loop Device	NRML, 4003C	

Defaults for Auto and Single sweep shown in bold.

Explanation of Terms:

Tuning: Selects the method of controlling the transmitter frequency during the test. If MAN or USER DEF is selected, the front panel UP/DOWN cursors are used to manually scroll the test tone frequencies up and down.

Sweep Rate: Three sweep speeds are provided: FAST: 3.5 secs; MEDIUM: 5 secs; SLOW: 10 secs.

Conditioning Type: Eight conditioning masks are available to automatically check compliance with circuit specifications. Level must be referenced to "0" in order to check Attenuation Distortion.

EDD Mode: The test set can be configured as the Master (measuring) unit or the Slave (repeating) unit. The test configuration (forward or return reference) is selected when the test starts.

Loop Device: When loop device 4003C is selected, the standard test tone frequencies of 1304 Hz through 2404 Hz, 2704 Hz and 2804 Hz will be automatically offset by -50 Hz. For example, 2704 Hz will become 2654 Hz to avoid activation of the TELLABS 4003 Line Amplifier during amplitude response or envelope delay measurements. When NRML is selected, the standard test tone frequencies are deployed.

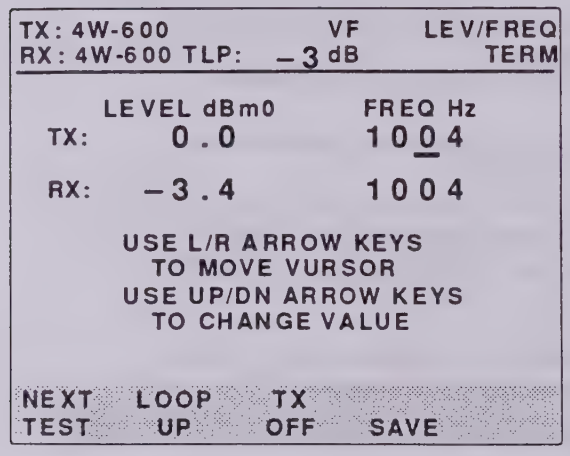
6.4 Test Procedures

6.4.1 Measuring Channel Loss

Channel loss is defined as the attenuation of a signal as it transits the circuit. It is measured at mid-band using a standard test tone level. Channel loss of a VF circuit is measured with a 1004 Hz tone. In order to understand "attenuation" in this context, it is necessary to understand the concept of Test Level Point (TLP), as explained in the side-bar on the next page. Levels annotated on circuit layout records can be actual power levels (dBm) or levels with reference to TLP (dB).

With the 5200, loss is measured using the Level and Frequency test selection. The transmitter will generate a test tone at the level set in the Interface Setup menu. Both the level and frequency can be changed during the course of the test, directly from the test results display. Default frequencies are 1004 Hz (VF), 10 kHz (Program), and 100 kHz (Wideband).

When a test is started, the Test Results display is automatically shown. The illustration shows a test results screen for a VF/4-wire interface set-up. Differences for other setups are noted below.



Level and Frequency Test Results
The header always identifies the test in progress (LEVEL & FREQUENCY).

Note the TLP. If other than "0", a correction is being applied to the measured (RX) signal. The correction is +3; thus, the actual measured level is –6.4 dBm.

The marker has been positioned below the 10s digit of the transmit frequency using the L/R arrow key.

Interface Variations

VF/2-wire: No LOOP control is provided. The TX OFF/TX ON key is replaced with SEND/MEAS which determines whether the set is receiving or sending a test signal. The display shows either the SENDING or MEASURING values, not both.

Program: Same as VF/2-wire.

Wideband: No LOOP control is provided. Impedance is fixed at 135 Ω.

Control Keys

NEXT TEST: Terminates the test and returns set to Test Selection menu.

LOOP UP/DOWN: (VF/4-wire only.) This key initiates transmission of the loop-control frequency (as selected in the INTERFACE SETUP screen).

TX OFF/TX ON: (VF/4-wire only.) Turns the transmitter off, but leaves the line terminated. This feature may be used to make idle noise measurements at the distant end.

Control Keys (Continued)

SEND/MEASURE: (All 2-wire modes.) Replaces QUIET/TX ON key. Interchanges the Receiver with the Transmitter.

SAVE: Saves the test results in non-volatile memory. Results may be recalled via the UTILITY softkey on the TMS/TIMS Test Selection Menu. Each file will be stamped with a test name, date and time. A total of 20 such files may be saved. When 20 files have been saved, a 'SAVE AREA FULL' warning will be displayed and the user will have to clear files that are not needed from the UTLY function.

Procedure

(1) Select Level-Frequency from the Main display. If the Interface setup is known to be correct, the test may be started immediately. If not, operate the setup key and verify parameters.

(2) The test starts with the default (mid-band) frequency or the frequency last used during this test. Verify that the transmitter frequency and level are set properly. Values may be changed while the test is in progress, as follows:

- Place the marker below the digit which is to be changed using the L/R arrow keys.
- Increment the digit up/down using the U/D arrow keys.
- Enter the desired value from the keypad; press ENTER to terminate the process.

(3) If necessary, perform a line loop-up. For 2-wire testing, coordinate sending/receiving directions.

(4) Note the frequency of the incoming signal to verify that test tone is present. Read level and calculate circuit loss, or deviation from expected level. *Note TLP! The RX level is stated in units of dBm0.*

(5) Change frequency and/or level and repeat test, if desired. For 2-wire set-up, reverse transmit/ receive function and repeat loss measurement in other direction.

Transmission Level Point (TLP):

Transmission Level Point describes a reference system in which a standard level test tone will be measured at the value specified by the "TLP" at that point in the circuit—disregarding channel loss/gain. It is stated in dB and the number indicates the correction which must be applied to level readings in order to correct it to standard level. Actual measured level is stated in "dBm", corrected levels in "dBm0", where the 0 indicates that it is corrected to 0 TLP.

The corrected value (dBm0) =
measured reading (dBm) – TLP value (dB).

Example: A reading of –3 dBm @ a –3 TLP = –3 – (–3) = 0 dBm0.

Test Level:

A 0 dBm0 test tone level is often used for VF circuits. For data circuits test tone level is almost always –13 dBm0. For analog facilities, it is extremely important that the correct test level be used while testing impairments in order to avoid overloading circuits. A PCM codec is linear to about +3 dBm0 and any signal greater than this is simply clipped.

Although this eliminates the overloading problem, test results will be totally erroneous at excessive levels. More is not better in checking a telephone circuit. Average speech power is actually in the order of –16 dBm0.

6.4.2 Measuring 3-Tone Slope and/or Attenuation Distortion

Attenuation distortion is defined as the variation of loss with frequency. The test consists of measuring signal level at various frequencies, with a standard level test signal applied at the distant end. There are several ways in which this data is processed for evaluation, and this leads to different terminology in describing test results. The following terms are used:

Frequency response: Raw data consists of a listing showing received level (in dBm) at different frequencies. This serves to demonstrate linearity of the channel but is not useful in checking circuit characteristics against a standard template since the mid-band loss is not normalized.

Attenuation distortion: Raw data is corrected to 0 dB LOSS to normalize results . Since the term is attenuation *distortion*, the sign of the processed results is reversed—*less* loss = *more* distortion, thus, is a positive (+) number. When graphed, however, positive (+) numbers are shown in the ascending direction, negative (–) numbers in the descending direction. (The graph looks like a frequency response curve normalized at 1004 Hz.) Templates for conditioned circuits are drawn this way.

The 5200 displays results in a frequency response format, or in normalized form if the Set 0 Ref feature is used. The sign convention for Attenuation Distortion is *not* observed. Results may be shown in either numerical or a graphical format.

The function selections include Slope (3-tone) or Amplitude Response, and various sweep modes are available for the latter. The illustrations show results for VF/4-wire interface selection.

```
TX: 4W-600          VF        SLOPE
RX: 4W-600 TLP:     0 dB       TERM

      LEVEL dBm        FREQ Hz
TX:   -10.0            1004
RX:   -13.4            1004

1st TONE   2nd TONE   3rd TONE
-13.4      -14.0      -14.5
 1004        404        2804

NEXT  LOOP                  SET
TEST  DOWN  STEP  SAVE   0 REF
```

Slope (3-tone) Test Results
A VF Frequency Response test made at 404, 1004, and 2804 Hz is a Gain-Slope test.

This example shows a looped test at a 0 TLP point. Note the LOOP DOWN key.

Transmit frequency for a Slope test is controlled by the STEP key. The test starts with 1004 Hz.

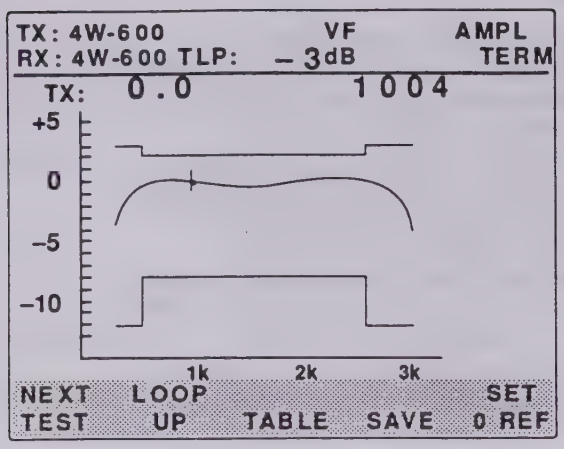
NOTE: The receive level shown next to Rx: is the absolute level and its units are dBm. The level shown for 1st, 2nd, 3rd tones are relative (with ZERO REF) their units are dB.

```
TX: 4W-600          VF        AMPL
RX: 4W-600 TLP:     -3dB       TERM

      LEVEL dBm        FREQ Hz
TX:    0.0             1004
LVL dB  FREQ Hz    LVL dB  FREQ Hz
-5.8     304       -5.0      404
-4.6     504       -3.9      604
-3.6     704       -3.3      804
-3.0     904       -3.0     1004
-3.1    1104       -3.2     1204
-3.1    1304

NEXT  LOOP                  SET
TEST    UP   GRAPH  SAVE   0 REF
```

Amplitude Response Test Results
This function is available for all interface and bandwidth selections.

This example has a 3 TLP, thus, a +3 dB correction is being applied to the measured value—and units are dBm0. The test is being made on an end-to-end basis (transmit and receive frequency are not the same).

The same data may also be displayed in a graphic format, although a 0 reference level at 1004 Hz should then be set.



Attenuation Distortion
The graphic display shows amplitude response normalized to 0 dBm @ 1004 Hz.

A conditioning mask (selected from the Interface Set-up menu) is also displayed.

The SET 0 REF feature *must* be used in order to check response against built-in templates.

Interface Variations

VF/2-wire: No LOOP control is provided. A SEND/MEAS key controls test direction by configuring set to transmit or receive. The display shows SENDING or MEASURING values, not both.

Program/Wideband: Same as VF/2-wire. No conditioning templates are provided.

Control Keys

NEXT TEST: Terminates the test and returns set to Test Selection menu.

LOOP UP/DOWN: (VF/4-wire only.) This key initiates transmission of the loop-control frequency (as selected in the INTERFACE SET-UP screen). See page 30.

SEND/MEASURE: (2-wire/Program modes.) Interchanges the receiver with the transmitter behind the line interface circuitry.

SET 0 REF: Applies a correction to the measured level such that "0 dBm" will be displayed at that level. This correction is applied for all levels measured during the test.

NOTE: The units for level is dBm when ZERO REF is not active and dB when ZERO REF has been activated.

SAVE: Saves the test results in non-volatile memory. Results may be recalled via the UTILITY softkey on the TMS/TIMS Test Selection Menu.

GRAPH/TABLE: Changes the results presentation between graphic and tabular formats.

NOTE: If 'AUTOREF' was selected from set up. This key will be ignored until the AUTOREF is completed.

Procedure

(1) The test starts with the default (mid-band) frequency, which for VF channels should always be 1004 Hz. Verify that the transmitter frequency and level are set properly. Values may be changed only from the Interface Setup menu.

(2) If necessary, perform a line loop-up. For 2-wire testing, coordinate sending/receiving.

(3) Note the frequency of the incoming signal (to verify that test tone is present). Read level in order to calculate circuit loss. *Note TLP!*

(4) Operate SET 0 REF key at reference frequency, if desired. If AUTO feature is selected, a message will indicate that reference tone is being sent and that a reference level has been set.

(5) Operate the START or STEP key to advance transmitter frequency.

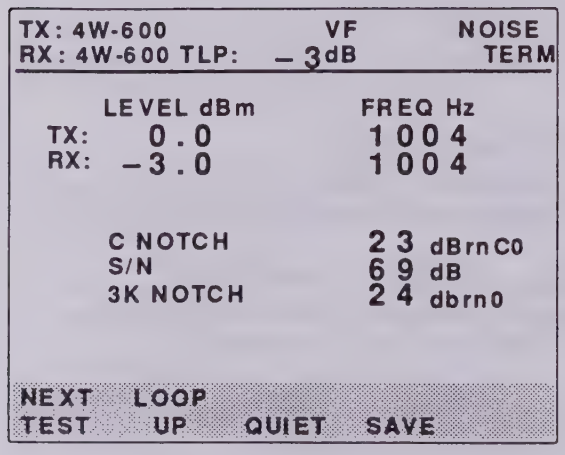
(6) Record results for each frequency, use graphical display, or PRINT all results at end of test.

6.4.3 Measuring Noise

Noise in a channel includes all undesirable energy in the pass band. It may be correlated in frequency with a signal in the channel or it may be random. Noise is measured with weighting filters which simulate the response of terminal equipment while the channel is carrying a test tone or is idle. For data applications, signal-to-noise ratio (S/N) is more important than weighted noise measurements.

In the 5200, the Noise test is made using both weighted and flat filters, and S/N is calculated automatically. For a noise-with-tone test, the transmitter generates a test tone at the level set in the Interface Setup menu.

In VF 2-wire/4-wire, the test automatically comes up in QUIET mode for idle channel noise testing. Pressing the NOTCH softkey turns the tone on for C-Notch noise. Program and wideband circuits only provide QUIET termination. The illustration shows test results for a VF/4-wire interface selection, Notch measurement.



Channel Noise Test Results
The header identifies the test in progress (NOISE) . Notched noise with both filters and S/N calculation are made simultaneously. S/N is based on the C-notched test.

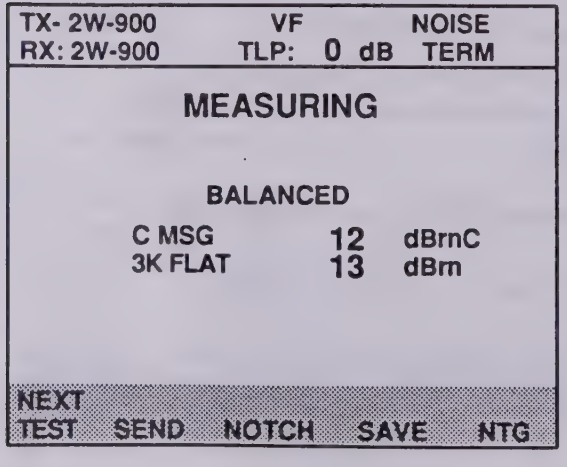
Note the TLP. If other than "0", a correction is being applied to the measured signal.

In this example, the displayed level and noise readings are corrected (by + 3 dB) and shown in units of dBm0 and dBrn0 respectively.

S/N is based on the C-notched value.

Interface Variations

VF/2-wire: No LOOP control is provided. A SEND/MEAS key controls test direction by configuring set to transmit or receive, displaying either SENDING or MEASURING values A NTG/BAL key configures the receiver for measuring noise-to-ground.
Program: A 2-wire, idle line test, with 15-kHz and program filters. See example on next page.
Wideband: A 4-wire, idle line test, with a single filter (50 kbit).



Two-wire Test Results
The transmitter provides a quiet termination for an idle line measurement and 1004 Hz test tone for a noise-with-tone test. A softkey toggles between idle line and noise-with-tone testing.

The test function can be reversed with the SEND key which is then replaced with a MEAS key.

A 'NOISE TO GND' measurement is invoked by the 'NTG' key which will be replaced with a 'BAL' key to return to balanced measurements.

Interface Variations

VF/2-wire:	A SEND/MEAS key is added to control direction of test. It configures the set to send tone or terminate the line , and the display shows either SENDING or MEASURING values. The test always starts in the MEASURING mode.
Program:	Same as VF/2-wire, except allows only idle line measurement, with 15-kHz program filter; noise with tone is not allowed.
Wideband:	Similar to VF/4-wire, except allows only idle line measurement, with a 50 kbit filter; impulse noise with tone is not allowed.

Control Keys

NEXT TEST	Terminates the test and returns set to Test Selection menu.
LOOP UP/DOWN	(VF/4-wire only.) This key initiates transmission of the loop-control frequency (as selected in the INTERFACE SET-UP screen).
SEND/MEASURE	(All 2-wire modes; replaces loop control key.) Interchanges the receiver with the transmitter behind the line interface circuitry.
QUIET/NOTCH	(VF interface only.) QUIET turns the transmitter off, but leaves the line terminated. This feature may be used to make idle-line noise measurements at the distant end. NOTCH turns test tone on. Note that when the measurement is switched between QUIET and NOTCH (or vise versa), it will default to the STOP mode. Press START to begin test.
SAVE	Saves the test results in non-volatile memory. Results may be recalled from the UTILITY function.
START/STOP	(All modes; not displayed when in 2-wire SENDING configuration.) Starts or stops (toggle action) the counters. All counters are cleared when the START key is operated. Measurement does not automatically start; user must press START key to begin test.

Procedure

(1) Select IMPULSE-HITS in the Test Selection menu . If the setup is correct, the test may be started immediately. If not, operate the SETUP key on the front panel and verify Test and Interface parameters.

(2) Operate START key to commence timed impulse noise count. The on-screen timer shows elapsed time. When complete, the timer stops. Press STOP to stop test at any time; press START to restart test.

(3) The test starts with holding tone transmitted at the default or last used level. From the display, verify that level is set properly. If not, press SETUP and change. For an idle channel measurement, operate the QUIET softkey.

(4) If the test is to be made on a round-robin basis, perform a line loop-up operation. For a 2-wire setup, coordinate sending/receiving directions.

(5) Verify that test tone is received at the correct level for noise-with-tone test. *Note TLP! The RX level is stated in units of dBm0.* The display will show the message LOSS OF TONE if holding tone is not present or is lost during the test.

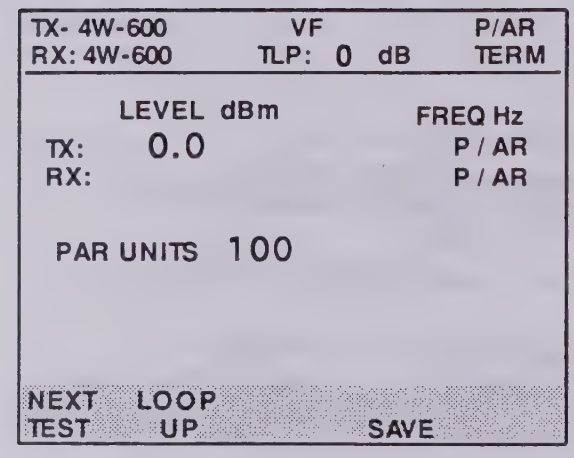
(6) Read counters and compare with expected results. Test data may also be saved in memory.

6.4.5 Measuring P/AR

The Peak-to-Average test provides a benchmark measurement for the purpose of evaluating the suitability of a channel to transmit VF data. The test is based on the transmission of a combination of frequencies which have a fixed relationship to each other in terms of power. The receiver measures the "spreading" in power among the different frequencies. The test is especially sensitive to phase distortion (EDD) and impaired signal-to-noise ratio, although values obtained with a P/AR measurement do not correlate well with results of standard impairment testing.

The 5200 performs a standard P/AR test on 2-wire or 4-wire VF channels. The reference display is 100 P/AR units, although it is common to see higher numbers on a back-to-back test.

When a test is started, the Test Results display is automatically shown. The illustration shows test results for a VF/4-wire interface selection.

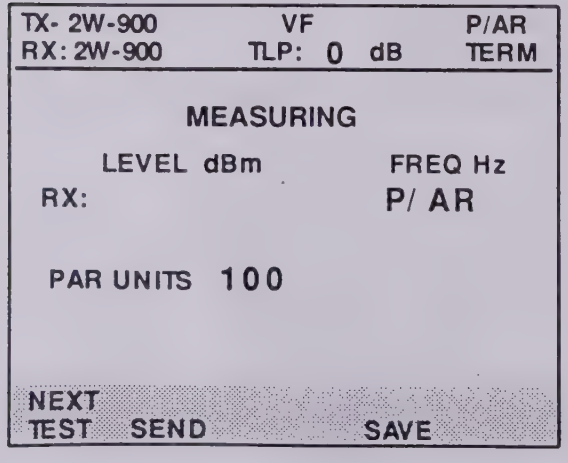


Peak-to-Average Test Results
The header identifies the test in progress (P/AR). The signal is unique, with a multi-frequency spectrum.

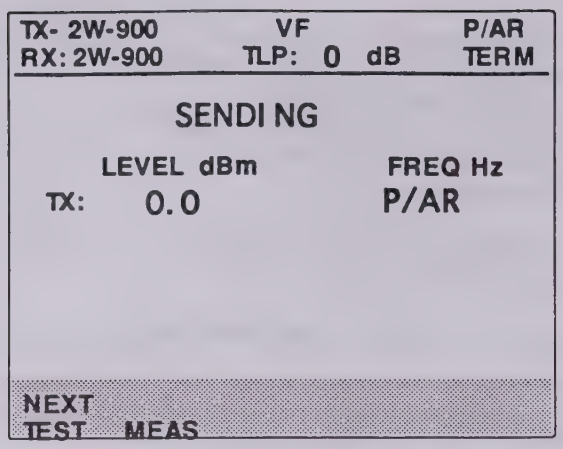
Interface Variations

VF/2-wire: A SEND/MEAS key is added to control direction of test. Interchanges the receiver with the transmitter. The display shows SENDING or MEASURING values, not both.

Program/Wideband: Test is not applicable.



P/AR Results, 2-wire Interface
For 2-wire testing, the set is configured to Transmit or Receive. This is controlled with the SEND/MEASURE key.



P/AR Sending Mode—2-wire Interface
The transmitter provides the standard P/AR signal to the two-wire line-under-test. A soft-key is provided to switch to Measuring mode.

Control Keys

NEXT TEST	Terminates the test and returns set to Test Selection menu.
LOOP UP/DOWN	(VF/4-wire only.) This key initiates transmission of the loop-control frequency (as selected in the INTERFACE SET-UP screen). Available on Test Selection menu only.
SEND/MEASURE	(VF/2-wire only.) Interchanges the receiver with the transmitter behind the line interface circuitry.
SAVE	Saves the test results in non-volatile memory. Results may be recalled from the UTILITY function.

Procedure

(1) Select P/AR in the Test Selection menu. If the setup is known to be correct, the test may be started immediately. If not, operate, the SETUP key on the front panel and verify Interface parameters.

(2) The test starts when the SELECT key on the Test Selection menu, or the TEST key on the Interface setup menu is operated. For a 2-wire arrangement, the set is placed in the MEASURING mode, thus one end or the other will have to switch to SEND operation.

(3) Read and record P/AR units.

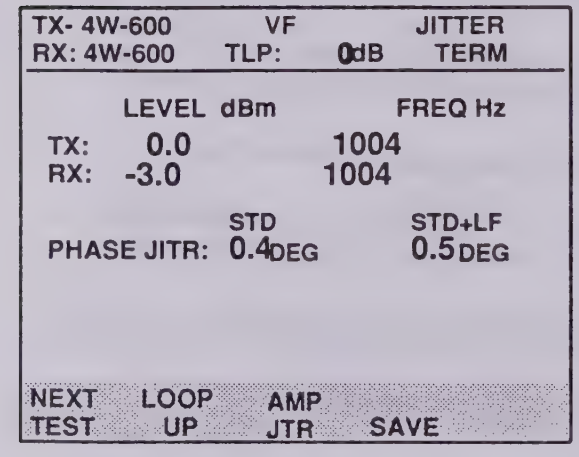
6.4.6 Measuring Jitter (Amplitude and Phase)

Incidental phase or amplitude modulation (jitter) in telephony is caused primarily by modulation of carrier supplies (in FDM equipment) by ringing generators and AC power influence. It is measured by transmitting a test tone on the VF channel, passing the tone through a bandpass filter (to limit out of band noise) and detecting the variations in phase/amplitude of the signal. The instantaneous excursions are weighed with one of two filters in order to extract those components which have the most serious impact on data transmission. These filters are:

- STANDARD; pass band is 20–300 Hz
- STANDARD + LOW FREQUENCY; pass band is extended down to 4 Hz.

The 5200 performs either amplitude or phase jitter measurement on 2-wire or 4-wire VF channels. Selection of amplitude/phase measurement is made by softkey from the Test Results display. Jitter is not defined for Program or Wideband channels.

The illustration shows test results for a VF/4-wire interface selection.



Jitter Test Results
The header identifies the test in progress (JITTER) and units define it as PHASE (deg) or AMPLITUDE (%).

Note the TLP. If other than "0", a correction is being applied to the measured signal level. TLP does not directly impact the measurement of jitter.

Measurements in the two weighted bands are made simultaneously.

The AMP JTR/PHS JTR key selects the test.

Interface Variations

VF/2-wire:	A SEND/MEAS key controls direction of test. It configures the set to send tone or to measure jitter. The display shows SENDING or MEASURING values, not both.
Program/Wideband	Jitter measurement is not provided.

Control Keys

NEXT TEST	Terminates the test and returns set to Test Selection menu.
LOOP UP/DOWN	(VF/4-wire only.) This key initiates transmission of the loop-control frequency (as selected in the INTERFACE SET-UP screen). Available on Test Selection menu only.
SEND/MEASURE	(VF/2-wire only.) Interchanges the receiver with the transmitter behind the line interface circuitry.
AMP/PHASE JITR	Selects the specific type of incidental modulation to be measured, amplitude or phase. Phase jitter is shown in degrees, amplitude jitter in (%).
SAVE	Saves the test results in non-volatile memory. Results may be recalled from the UTILITY function.

Procedure

(1) Select JITTER from the Test Selection menu. If the setup is known to be correct, the test may be started immediately. If not, operate the SETUP key on the front panel and verify Interface Set-up parameters.

(2) When the test starts, holding tone is transmitted at the default or last used level. From the display, verify that level is set properly. Transmit level may be changed from the Interface Set-up menu.

(3) If the test is to be made on a round-robin basis, perform a line loop-up operation. For a 2-wire set-up, coordinate sending/receiving directions.

(4) Verify that test tone is received at the correct level. *Note TLP! The RX level is stated in units of dBm0.* The receive level display will be replaced with the message NO TONE if holding tone is not present or is lost during the test.

(5) The LF measurement takes approximately 25 seconds to stabilize. Test results will be displayed when available.

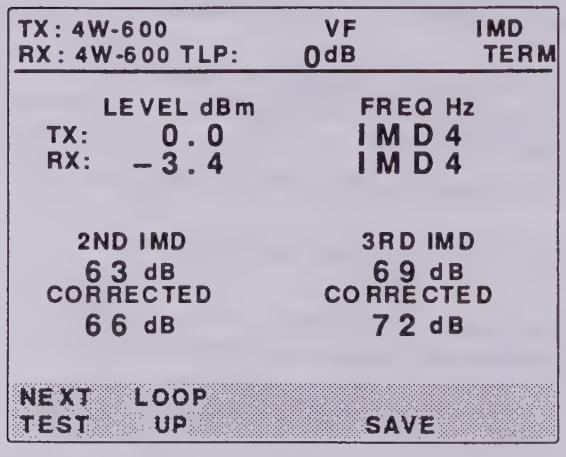
(6) Display may be toggled to show amplitude jitter. Test data may be saved in memory.

6.4.7 Measuring Intermodulation Distortion

Intermodulation distortion consists of "noise" components which are caused by channel non-linearity, which produce extraneous harmonics. The standard technique is based on the transmission of two tone pairs and the measurement of harmonics + noise in three narrow bands. The bands are selected to include second and third order harmonic components. The noise component in these same bands is then measured by changing the transmitted pattern such that no harmonic components fall in the bands yet retain the same power level. Separation of "noise" into two parts, frequency related and non-correlated, can be useful in troubleshooting transmission impairment.

The 5200 performs the standard non-linear distortion measurement on 2-wire or 4-wire VF channels. This test is not available for Program or Wideband channels.

The illustration shows test results for a VF/4-wire interface selection.



Intermodulation Distortion Test Results
The header identifies the test in progress (IMD).

Note the TLP. If other than "0", a correction is being applied to the measured signal level. TLP does not directly impact the measurement of intermodulation distortion.

Both 2nd and 3rd order distortion products are measured simultaneously. Noise correction (measured with two-tones) are applied automatically.

Interface Variations

VF/2-wire: A SEND/MEAS key replaces the LOOP key) . It configures the set to send tone or to measure distortion. The display shows SENDING or MEASURING values, not both.

Program/Wideband: Intermodulation distortion measurement is not provided.

Control Keys

NEXT TEST	Terminates the test and returns set to Test Selection menu.
LOOP UP/DOWN	(VF/4-wire only.) This key initiates transmission of the loop-control frequency (as selected in the INTERFACE SET-UP screen). Available on Test Selection menu only.
SEND/MEASURE	(VF/2-wire only.) Interchanges the receiver with the transmitter behind the line interface circuitry.
SAVE	Saves the test results in non-volatile memory. Results may be recalled from the UTILITY function.

Procedure

(1) Select IMD from the Test Selection menu. If the setup is known to be correct, the test may be started immediately. If not, operate the SETUP key on the front panel and verify Interface Set-up parameters.

(2) When the test starts, the 2-tine signal is sent first and then the 4-tone signal is sent . Both signals are sent at the default or last used level. From the display, verify that level is set properly. Transmit level may be changed from the Interface Setup menu.

(3) If the test is to be made on a round-robin basis, perform a line loop-up operation. For a 2-wire set-up, coordinate sending/receiving directions.

(4) Verify that test tone is received at the correct level. *Note TLP! The RX level is stated in units of dBm0.*

(5) The transmitter alternately transmits the 2-tone (noise check) and 4-tone patterns for the duration of the test. The receiver detects the change in patterns and automatically applies the noise correction.

(6) Test data may be saved in memory.

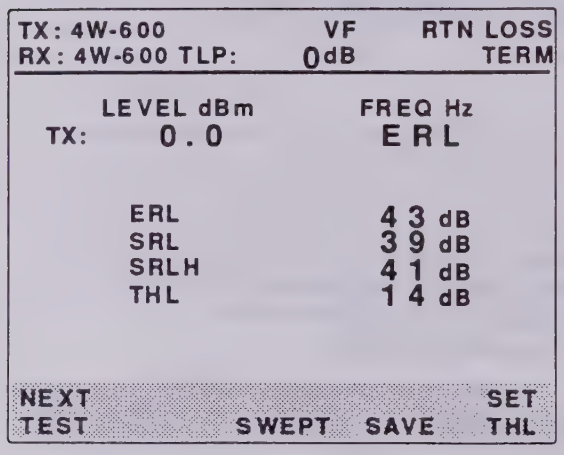
6.4.8 Measuring Return Loss

Return loss measures the quality of the termination of the LINE side of a 4/2-wire transition point—the hybrid. It is not a transmission impairment as such, although poor termination can cause serious problems to the transfer of intelligence via a telephone circuit. Relating return loss measurements to circuit requirements mandates that correction for hybrid and transmission loss be applied and this requires some form of manual intervention during the test.

The 5200 measures Return Loss from a 2-wire or 4-wire VF access point. The test set has compensation for internal trans-hybrid loss (100% reflection at the 2-wire line connection produces a reading of 0 dB return loss). Transmission loss can be compensated by using the SET THL feature. Otherwise, the correction must be made with a numerical subtraction of the measured results. For a 4-wire arrangement, THL *and* transmission loss are compensated by using this feature.

This test is not available for Program or Wideband channels.

The illustration shows test results for a VF/4-wire interface selection.



Return Loss Test Results
Return Loss is measured in three frequency bands—low, mid, and high.

No TLP correction is applied to the measured value of return loss.

THL (LOSS) correction may be made as described in *Procedure.*

Interface Variations

VF/2-wire:	Display of results is the same as shown. Interface parameters are different, as selected from the Set-up menu.
Program/Wideband:	Return Loss measurement is not provided.

Control Keys

NEXT TEST	Terminates the test and returns set to Test Selection menu.
SWEPT/STD	STD measures echo return loss in three bands. SWEPT measures structural return loss using a swept frequency which covers the VF range 300–3400 Hz. THL/LOSS correction is not applicable to the measurement of structural return loss.
SAVE	Saves the test results in non-volatile memory. Results may be recalled from the UTILITY function.
SET THL	The signal level measured when this key is operated will be displayed as 0 dB. The correction is shown as THL.

Procedure

(1) Select RTN LOSS from the Test Selection menu. If the setup is known to be correct, the test may be started immediately. If not, operate the SETUP key on the front panel and verify Interface Setup parameters.

(2) When the test starts, a 400 msec burst of echo canceller disable tone (2125 Hz) is transmitted at the default or last used level. ERL tone is then transmitted, followed in sequence by SRL-L and SRL-H. The transmit level defaults to -10 dBm.

(3) To correct for transmission loss (2-wire) or THL + transmission loss (4-wire), proceed as follows:

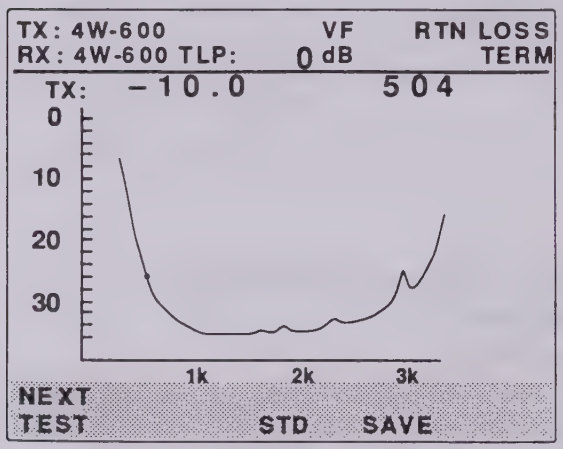
- When the test starts, operate the SET THL key.
- Replace the *termination* on the LINE side of the hybrid with a short. This will reflect 100% of the power back to the hybrid, thus, equals 0 dB return loss.
- Set this level as zero reference by pressing the SET THL key a second time..
- Replace the line short with the normal termination and read RL.

(4) The test continues, alternating with ERL, SRL-L, and SRL-H until stopped.

(5) For a point-by-point measurement of return loss, switch to SWEPT using the softkey provided. This mode does not correct for loss/THL.

(6) All test data may be saved in memory.

Structural Return Test Results Display
Single frequency return loss is displayed in a graphic format.



Structural Return Loss graph
The swept mode produces a picture of return loss vs. frequency. It is useful in detecting anomalies within the pass band.

6.4.9 Measuring Envelope Delay Distortion

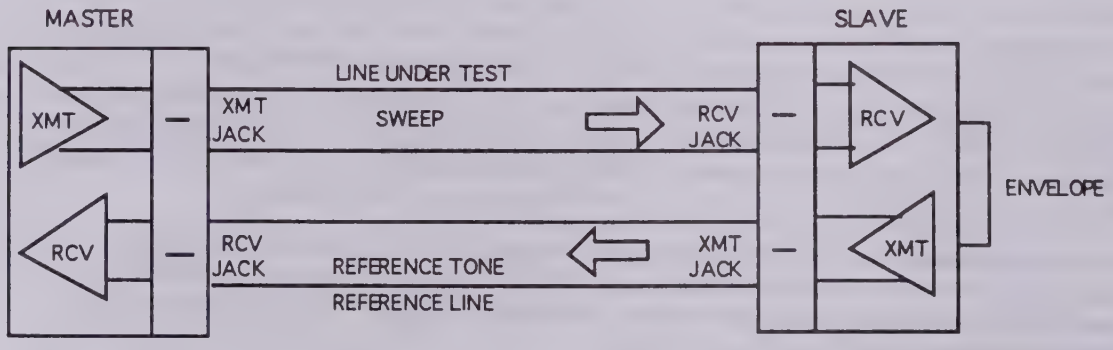
Envelope Delay Distortion is defined as the variation of phase delay with frequency in the pass band. The test is made by measuring the change in phase of a low frequency modulation envelope superimposed on a VF carrier frequency. Since it would be extremely difficult to establish a common phase reference at both ends of a circuit, the Master set located at one end of the channel generates the test signal and conducts the measurement. A Slave set at the distant end simply repeats the modulation envelope and input level changes (of the receive signal) on its transmitted carrier. By sweeping one direction, and maintaining a constant carrier in the other direction, the response of only one direction of transmission is measured.

If the forward direction (from the Master) is to be measured, the Master sweeps the band of interest and the Slave returns the line parameters on a constant carrier. This arrangement is called RETURN REFERENCE. If the return direction is to be measured, the Master sends the reference carrier and the the slave sweeps the return path. This is called a FORWARD REFERENCE arrangement.

In the 5200, a phase reference is set by the Master unit when the direction to be measured is carrying 1804 Hz, with the expectation that all other measured values will be positive. A level reference (at 1004 Hz) may be established manually using the SET 0 REF key.

Return Reference

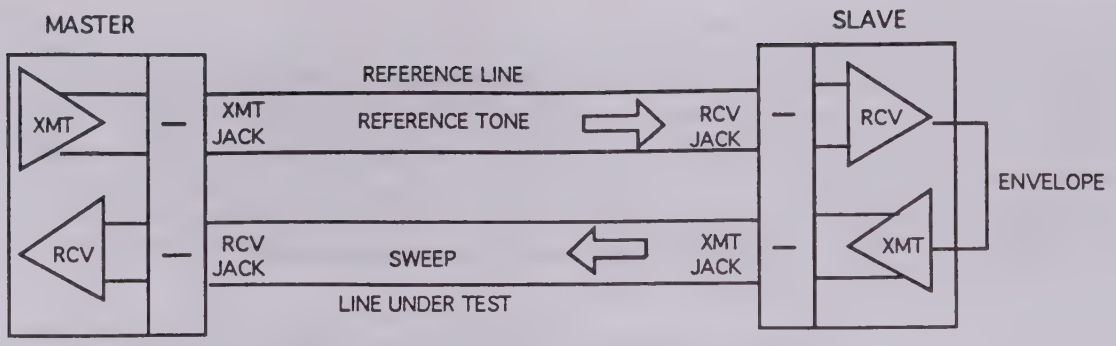
In return reference, the "master" 5200 transmits a series of frequencies (a "sweep"), modulated by 83 1/3 Hz, to the far-end "slave" 5200 (or other test set). The slave 5200 recovers the modulation, applies it to a fixed carrier tone (a"reference tone", usually 1800 Hz), and sends it back to the master 5200 for measurement. In this mode, the slave 5200 also retransmits at the same level it receives the signal. Therefore, the master 5200 measures the delay and amplitude gain characteristics of the "forward" or transmitting line.



Return Reference

Forward Reference

In forward reference, the master 5200 transmits the fixed reference tone, modulated by 83 1/3 Hz, to a far-end slave 5200 (or other test set). The slave 5200 recovers the modulation, applies it to a sweep of frequencies, and then returns the signal to the master 5200. In this mode, the slave 5200 "normalized" (or zero references) output levels. Thus, the master 5200 measures the delay and amplitude gain characteristics of only the return line.



Forward Reference

Setting Up An Envelope Delay Distortion Test

The 5200 makes performing EDD a very simple task. Sweep rates, start and stop frequencies, and mode are all selected on a test Setup menu accessed via the dedicated SETUP key. Once all parameters are selected, pressing the TEST softkey on the Setup Menu will return you to the EDD measurement screen. The 5200 will then begin testing automatically. You may change reference direction, set the 0 reference point, view results in either a tabular or graphic mode, and save these results directly from the measurement screen by pressing the appropriate softkey. You can return to the Setup menu any time to change other parameters, but the test will stop and begin again when you return to the measurement screen. Review paragraph 5.3.3, Envelope Delay Distortion Test Menu, before beginning the procedures described below.

Procedure

(1) Select EDD from Test Selection display. If the setup is known to be correct, the test may be started immediately. If not, operate the SETUP key on the front panel and verify test and interface parameters. Mode (Master or Slave) is selected from the Test Setup.

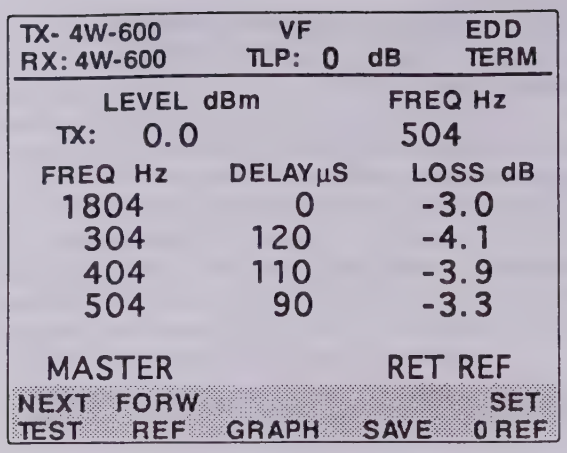
(2) The Master automatically begins the test by transmitting 1804 Hz, in a Return Reference arrangement. Verify that the level is set properly at both sets. Level may be changed from the Interface Setup menu. It is important that the test level not be "hot" for this test because limiting in the channel during the test will lead to erroneous level readings.

(3) If Auto or Single sweep is selected in Setup, the Master 5200 will automatically begin transmitting a sweep as soon as the level has stablized (within a couple of seconds). If Manual Tuning is selected in Setup, use the front panel UP/DOWN cursor keys to step through each frequency.

4) On the Master unit, operate the SET 0 REF key when the line-under-test is carrying 1004 Hz. (This is only necessary if attenuation distortion is to be displayed directly.) Prior to recording test results for all tuning modes, it is necessary to manually tune through the response to locate the fastest frequency. In this manner, negative delay test results will be eliminated and the selected conditioning mask will be correctly utilized to provide graphical verification of compliance with conditioning specifications.

(5) Record results for each frequency, use graphical display, or PRINT all results at conclusion of test.

(6) Change reference direction from Return Reference to Forward Reference and repeat procedure.



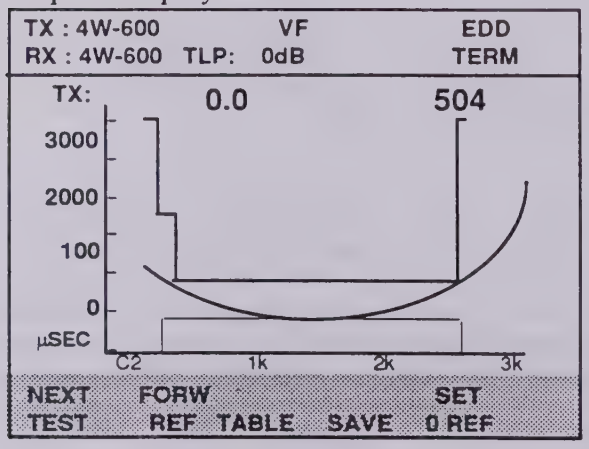
EDD Test Display
Mode (Master or Slave) is selected in Setup. The reference direction is selected from the test display via softkey.

In this example, the 5200 is in MASTER mode and RETURN REF. The set transmits 1804 Hz in the forward direction in order to establish a reference phase measurement. The SLAVE retransmits the modulation envelope on a reference carrier.The measuring set will automatically set delay to zero at start of test (when 1804 Hz is being transmitted). Level must be set manually.

Control Keys

NEXT TEST	Terminates the test and returns set to Test Selection menu.
FORW/RET REFERENCE	Determines which side of a channel will be used to carry the reference (fixed frequency) carrier.
SAVE	Saves the test results in non-volatile memory. Results may be recalled from the UTILITY function. The file specified in the Interface setup menu will be used and results already in that location will be over-written.
GRAPH/TABLE	Changes the display presentation from tabular to graphic. NOTE: This key will be ignored if it is pressed during automatic phase reference (initial 5 sec).
SET 0 REF	Applies a correction to the measured level such that "0 dBm" will be displayed at that level. This correction is applied for all levels measured during the test.

Graphic Displays

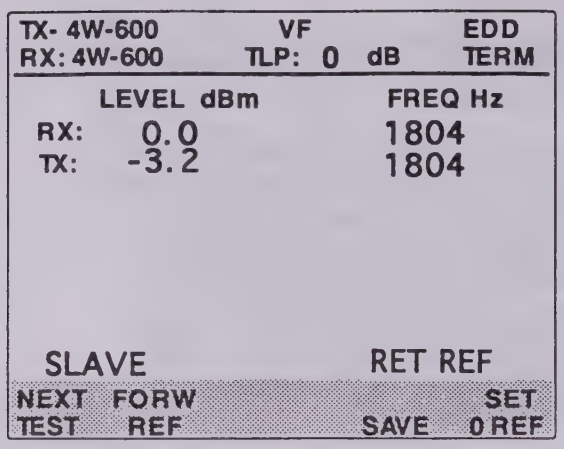


EDD Conditioning Check
The graphic display shows either EDD or amplitude response, normalized to 0 dBm @ 1004 Hz.

A conditioning mask (selected from the Interface Set-up menu) is also displayed.

The SET 0 REF feature *must* be used in order to check attenuation distortion against built-in templates.

The display control soft-key toggles between a Table display to a graph .



EDD Slave Display

Control selection is similar to that of the Master unit except that the Tabular/Graphic display softkey is eliminated.

The Slave set displays only level and frequency, since no other measurements are being made.

Technical Notes

A 83.3 Hz modulating frequency is typically used and this provides unambiguous measurement of up to 9000 µsec of phase difference. The reference carrier is placed in the area of least phase change, i.e., at 1804 Hz in the VF band. The Slave set can also repeat level changes, which makes it possible to conduct a complete *channel response* measurement in one test. Test tone level must be chosen with some care to avoid overdriving the channel and/or the test set receiver. For large changes in level, amplitude-to-phase conversion may also distort the EDD readings.

7. BASIC DIALING FUNCTIONS

The basic 5200-17 has dial/hold/talk features suitable for testing 2-wire dial-up lines. In effect, the standard features provide station simulation for a loop-start line. No signaling measurements as such are provided.

Figure 7-1 illustrates the operating sequence from the DIAL function on the Main menu. Capability includes holding a dial-up line, dialing a number directly or from a previously stored list, and conducting any TMS test. All functions are available from the standard TMS Test Selection menu, as described in Section 5. When the TMS functions are used, normal setup procedures for these tests are active—except that the interface type is preselected by virtue of entering this mode from the DIAL function (i.e, 2-wire interface).

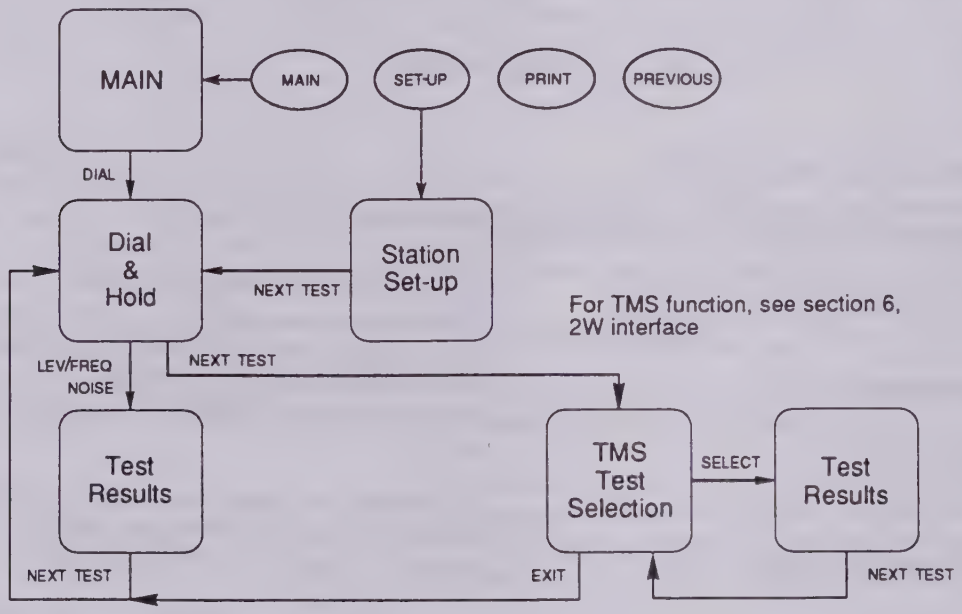


Figure 7-1: Operating Sequence from DIAL Function

7.1 Dial-Up Interface

The 2-wire Dial/Hold/Talk functions of the standard TMS set are illustrated in figure 6-2. An electronic holding circuit maintains a constant loop current, provided that the loop resistance does not exceed the limits. Conventional dial pulsing is provided behind the transfer circuits on the transmit leg of the test set.

A transfer function located between the holding circuit and the measuring circuits is used to swap the function of the test set from transmit to receive—or to connect the Dial/Talk circuits to the receive jack connection.

The 5200 provides a connection for a standard telephone set which may be used to talk on a 2-wire line that provides talk battery. The telset connection will be cut-off internally whenever the test set is in a testing mode.

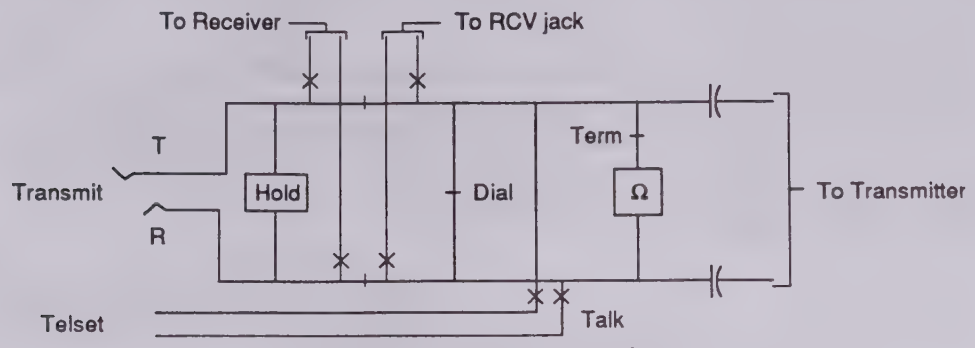
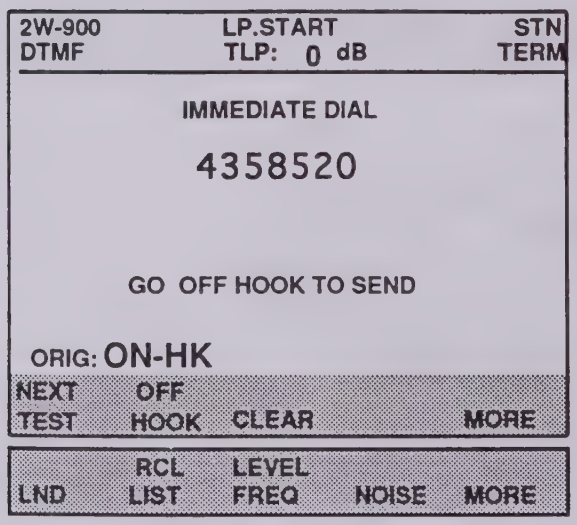


Figure 7-2 : Dial-Up Interface

7.2 Dialing a Telephone Number

Dial functions are controlled from a simple mode menu, shown below.



Loop-Dial/Station Mode Screen
The header shows the DIAL setup . The Dial function provides a Station interface with a 2-wire line only. Variable parameters can be changed from the Setup menu.

The display indicates the number presently entered. When first powered up, the display will read "NO PHONE NUM".

The *status line* shows the status of the 5200 as telset. Here, it is on-hook.

Telephone numbers may be selected and dialed in four ways:

(1) Go OFF-HOOK and dial directly from the keypad. The number will be dialed out as it is entered. It will also write to the screen.

(2) Enter entire number from the keypad while 5200 is ON-HOOK. The number will write to the screen. Then go OFF-HOOK and the number will be dialed with the appropriate machine timing.

(3) Press "LND" to recall the last number dialed. Press OFF-HOOK to dial.

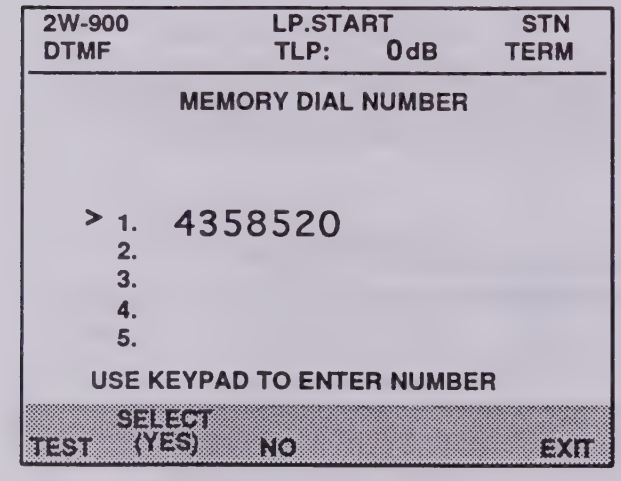
(4) Press RCL LIST to recall the list of telephone numbers stored in Utilities. After selecting a number, press OFF-HOOK and the 5200 will automatically dial out the number..

Control Keys

NEXT TEST	Advances to TMS/TIMS Test Selection Menu.
OFF/ON-HOOK	This key controls the switch-hook. This function is available only from the Dial menu. Thus, it is necessary to return to this screen in order to properly terminate a telephone connection after testing.
CLEAR	Clears the entered digits from the Dial Menu screen.
LND	Recalls last number dialed
RCL LIST	Recalls Memory Dial List. You can select a previously entered number or enter a new number to the list.
LEVEL FREQ	Goes directly to Level/Frequency measurement, bypassing the TMS Test Selection Menu.
NOISE	Goes directly to Noise measurement, bypassing the TMS Test Selection Menu.

Memory Dial List

The dial function is often used to call test lines located in central offices in order to conduct one-way transmission testing. Frequently called numbers may be stored in a memory dial list as shown below. Each digit type (DP. MF, DTMF) has a separate list. When the digit type is selected in Setup, the telephone list for that digit type is available from the Dial Menu via a RCL LIST softkey.



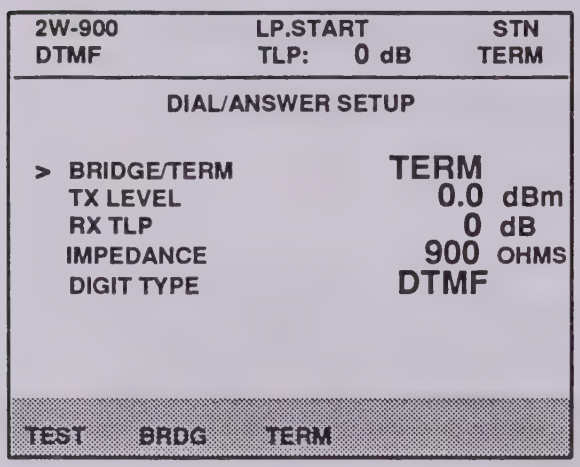
RCL LIST Screen

The list of stored telephone numbers is accessed when RCL LIST is pressed.

Move Up/Down cursor to select a telephone number. Enter new number via keypad. Old number is automatically cleared when the first number is entered from the key pad.

7.3 Dial Setup Menu

The Dial function in the basic 5200 is restricted to interfacing a loop-start line as a station, i.e., the set acts as a standard telephone. Variable parameters include type of digits dialed and line impedance. Level/Frequency and Noise tests can be accessed directly; thus, the Setup menu associated with this function provides a means of setting line termination, adjusting TLP, and saving test results.



Dial Setup Menu
Header shows existing selections. This function emulates a standard telephone set.

Use Up/Down arrow keys to select item.

Parameter selections appear on softkeys.

TEST returns to the Dial menu.

NOTE: There is no interface selection since DIAL lines are 2W loop start only.

The selections for each of the parameters on the Dial Setup menu are as follows (defaults are in bold):

BRIDGE/TERM	Bridged or **Terminated**
TX LEVEL	**0 dBm**, -10 dBm, -13 dBm, -16 dBm, or enter from keypad
RX TLP	**0 dB**, -3 dB, 7 dB, or enter from keypad
IMPEDANCE	600 ohms, **900 ohms**
DIGIT TYPE	**DTMF**, MF, or DP

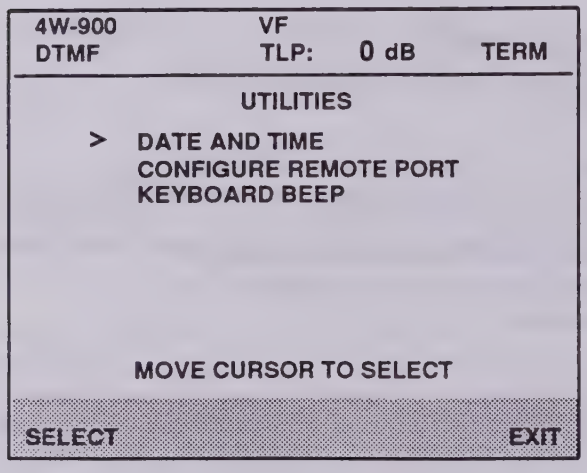
The TEST softkey returns to the Dial menu.

8. UTILITY FUNCTIONS

There are two types of Utility functions in the Model 5200-17: (1) those that relate to the overall operation of the unit and accessed from the Main Menu; and (2) those that relate specifically to TMS, Signaling (Option A), of DS1 (Option C) test functions and accessed from the Test Selection menu of each test function. The following screens show the capabilities provided under each type of Utility.

8.1 Results Files

The following screen shows the selections available in the Utilities selection on the 5200-17 Main Menu.



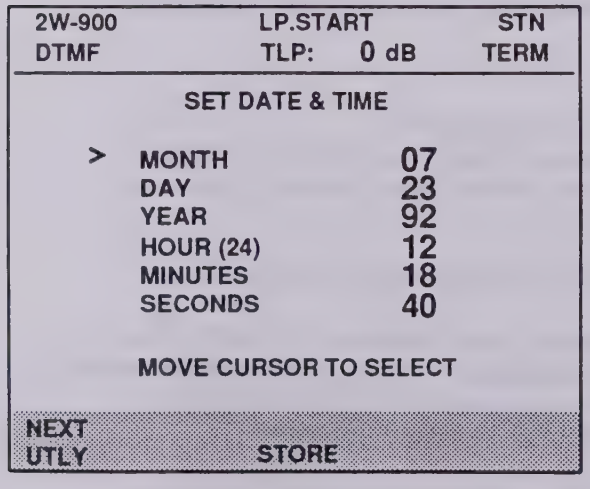
Utilities Mode Menu
The header reflects the last interface settings. However, no external connections are active.

Use U/D arrow keys to mark the item of interest. When selected, one of two things happens:

- an operational menu is presented
- the item requires a simple on/off response.

8.1.1 Date and Time

This selection sets the date and time.



Date and Time Menu
The header shows the last interface settings.

Use U/D arrow keys to mark the element you wish to change. Then use keypad to enter new value and press STORE to save.

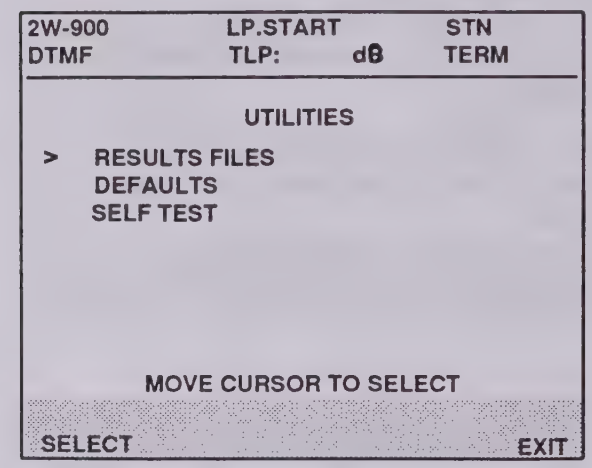
NEXT UTLY returns you to Main Menu.

8.1.2 Remote Port Configuration
Not available at this time.

8.1.3 Keyboard Beep
This function allows you to turn off the key response tone. When selected, the screen will ask if you wish to turn off the beep. You may select YES or NO.

8.2 Test Function Utilities

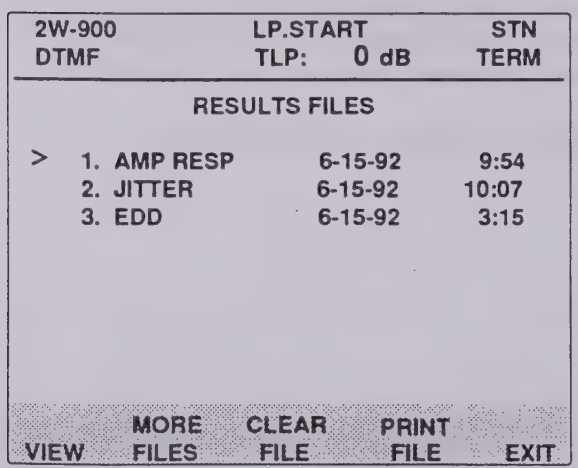
Another set of Utility selections is available from the TMS/TIMS Test Selection Menu. These selections relate specifically to TMS testing.



TMS Utilities
The header reflects the last interface settings.

Use U/D arrow keys to mark the item of interest. When selected, one of two things happens:
- an operational menu is presented
- the item requires a simple yes/no response.

8.2.1 Results Files
Test data saved from any test function may be recalled by using this selection. Data is stored as a series of screens, similar to those used to show Test Results during the test, that are labeled and date stamped for easy identification.



Test Results Files
Results files are stored by number and identified by name, date and time of the original test.

Use U/D arrow keys to select file.

VIEW Recalls the selected file. The data is presented in the format of the Test Results displays used in the original test, with multiple screens if necessary.

EXIT Returns to the UTILITIES menu.

Approximately 20 tests can be stored and recalled. However, some tests, such as Amplitude Response require a significant amount of memory and may reduce the number of test results that can be stored. Once the Results Files memory is full, future save commands will overwrite existing files. In such an event, the 5200 will display a warning message.

VIEW	Recalls the selected file. The data is presented in the format of the Test Results displays used in the original test, with multiple screens if necessary. From within the "viewed" file, you may also clear or print the file.
MORE FILES	Presents any additional pages of file listings.
CLEAR FILE	Erases the selected file.
PRINT FILE	Prints the selected file.
EXIT	Returns to the Utilities Menu.

8.2.2 Defaults

All parameter selections will be set to factory defaults. This may be useful when acquiring a set which has been used elsewhere and settings do not suit the intended operation.

8.2.3 Self Test

The test set will conduct a thorough memory check and internal operational measurements in order to determine that normal operation is possible. In this process all user entered data are erased, including test parameter selections and test results. This function may be used when there is some reason to suspect accuracy or operation of the set. There is no need to exercise it routinely.

This page intentionally left blank.

9. ACCEPTANCE TEST AND CALIBRATION PROCEDURES

9.1 Introduction

The information contained in this chapter will help technical personnel maintain the Model 5200-17. These procedures are to be performed by trained technical personnel who are familiar with the equipment characteristics and who understand and apply all necessary safety precautions during any phase of maintenance or operation.

9.2 Test Equipment Required

The following test equipment is necessary for the performance verication and calibration procedures:

(1) Fluke 5200-17A AC Calibrator or equivalent
(2) Fluke 8810A DMM or equivalent
(3) Fluke 1900A Multicounter or equivalent
(4) Sound Technology 1710A or equivalent
(5) Hewlett-Packard 6294A DC Power Supply or equivalent.
(6) Shunt Terminations: 600, 900, 1200, 150, and 135 ohms
(7) Series Terminations: 600, 900, 1200, 150, and 135 ohms
(8) Bradley Model 2A Hits and Jitter Synthesizer or equivalent
(9) CXR 704A2 Wideband Test Set or equivalent
(10) 600 ohm, 5W resistor
(11) Epson FX- 86E parallel printer or equivalent
(12) 135 ohms series impedance
(13) 310 to double banana cable
(14) 310 to 310 cable

9.3 Safety Precautions

As with other instruments, general safety precautions must be observed during any part of operation, service, and repair of the Model 5200-17.

(1) **Voltage:** Dangerous voltage potentials (such as the 120/240 AC power line) are present inside and under the main circuit board when the 5200-17 covers are taken off. This voltage level is capable of causing death or serious injury. Be sure to unplug the power cable before performing cleaning, inspection, calibration, or repair routines.
(2) **Fuses:** Never use a fuse other than one of the specified rated value.
(3) **Power:** Never operate the test set from an AC line different than that specified on the rear panel voltage selector.

(4) **Battery:** The 5200-17 utilizes high output energy NICKEL-CADMIUM batteries which, when fully charged and accidentally shorted, are capable of melting wire and metals, explosion, starting a fire, or spewing out hot, strong-alkaline electrolyte oxygen and hydrogen gases. Be certain to remove any metal from your body (such as metal watchbands, rings, or bracelets, etc.) when servicing the 5200-17 with NiCad batteries installed.

(5) **Soldering:** Soldering of wires and components must be performed only by personnel familiar with the techniques that produce the desired results without risking damage to or causing future malfunction of the equipment. An approved electrostatic discharge protected solder iron and desolder pump is required.

(6) **Unauthorized Modifications:** Because of the danger of introducing additional hazards, do not perform any unauthorized modification to the equipment.

(7) **Parts Removal:** Do not remove components from the circuit board assemblies unnecessarily. Before replacing new components, be sure that lead wires/pins are properly aligned so damage does not result. Replacement parts must be installed with correct orientation and/or observance of polarity.

9.4 Preventative Maintenance

9.4.1 Cleaning

Use a damp rag and a mild solution of household detergent (1% detergent to 99% water) to clean dirt from the exterior. Stubborn stains, grease, etc. may be cleaned with alcohol. The LCD is covered with a light plastic shield which should not be subjected to harsh treatment of any sort.

The fan blows air out of the set, thus, is not equipped with a filter. Accordingly, the set should not be operated in a location or position where excessive amounts of dirt will be picked up by sir flowing into the test set.

9.4.2 Circuit Board Inspection

Inspect all chassis-mounted components and circuit boards for any visual indications of potential failure and correct as necessary. Items specifically to be checked are:

(1) Discolored or burned components, especially resistors.
(2) Leaking or ruptured capacitors.
(3) Worn or broken connector pins.
(4) Abraded wire insulation.
(5) IC devices popping out from their sockets.
(6) Molded cable connectors coming off their connections.
(7) Cracked printed circuit boards or lifted circuit traces.

9.5 Performance Verification

The following procedures will verify the performance of the Model 5200-17 and should be used in performing incoming inspection, routine maintenance, and general post-repair checks.

9.5.1 Required Test Equpment

(1) Fluke 5200-17A AC Calibrator or equivalent.
(2) Fluke 8810A DMM or equivalent.
(3) Fluke 1900A Multicounter or equivalent.
(4) Sound Technology 1710A or equivalent.
(5) Hewlett-Packard 6294A DC Power Supply or equivalent.
(6) Shunt Terminations: 600, 900, 1200, 150, and 135 ohms.
(7) Series Terminations: 600, 900, 1200, 150, and 135 ohms.
(8) Bradley Model 2A Hits and Jitter Synthesizer or equivalent.
(9) CXR 704A2 Wideband Test Set or equivalent.
(10) 600 ohm, 5W resistor.
(11) Epson FX- 86E parallel printer or equivalent.

9.5.2 Continuity Check

(1) Remove the power cord from the Model 5200-17.
(2) Using the DMM, verify that tip and ring of all 310 jacks are open (>20 kohms).
(3) Verify that the sleeves of all 310 jacks are shorted (<10 ohms).
(4) Verify that S/G terminal is shorted to the AC third pin (<10 ohms).

9.5.3 DC Blocking

(1) Power up the Model 5200-17.
(2) Apply -48 Vdc across the RCV jack. The DC current draw should be 0.
(3) Apply -48 Vdc across the XMT jack. The DC current draw should be 0.

9.5.4 Self Test

(1) Press TMS, on the main menu. The TMS/TIMS Test Selection menu should come up.
(2) Press UTLY (SK 4) on the Test Selection Menu. Then select SELF TEST from the list of Utility functions.
(3) Verify the revision number of the firmware.
(4) Run self test and verify that there are no failures.
(5) Return to the main screen. by pressing MAIN (+SHIFT) on the front panel.

9.5.5 Transmit Level Check

(1) Select TMS from the main screen.

(2) With the cursor at LEVEL/FREQ., press the SETUP key on the front panel and verify the following settings:

INTERFACE	4W
BRDG/TERM	TERM
TX LEVEL	0.0
TAX TLP	0.0
SF SKIP	ON
TX IMP	600
TX IMP	600
LOOPBACK FREQ.	2713

(3) Press TEST.

(4) Connect the CXR 5200 XMT jack to the DMM with a 600 ohm shunt termination.

(5) Verify that the DMM readings are within limits shown in the following table.

(6) Position the cursor under TX Level, using the left/right arrow keys.

(7) Change the TX Level to +10 dBm, using the up/down arrow keys.

(8) Verify DMM readings.

(9) Repeat with the TX Level set to -40 dBm.

5200 Transmit Level (dBm)	DMM Reading (Vac)	(dBm)
0.0	0.7657 to 0.7836	0.0 ± 0.1
+10.0	2.3937 to 2.5065	+10.0 ± 0.2
-40.0	0.0075 to 0.0079	-40.0 ± 0.3

9.5.6 Transmit Frequency Response

(1) Change TX level to 0.0 dBm.

(2) Position the cursor under TX Frequency, using left/right arrow keys.

(3) Select proper step size by position of the cursor.

(4) For the transmit frequency shown, verify the DMM reading to be within tolerances.

(5) Press NEXT TEST and then SETUP

(6) Change Interface type to PROG.

(7) Press TEST, SELECT, and SEND to verify per table.

(8) Press NEXT TEST and then SETUP.

(9) Change Interface type to WIDEBAND.

(10) Change the shunt impedance of the DMM to 135 ohms.

(11) Hit TEST, SELECT and verify DMM readings per table.

5200 Transmit Band	Freq. (Hz)	DMM Reading (Vac)	(dBm)
VF	50	0.732 to 0.821	0.0 ± 0.5
VF	200	0.757 to 0.793	0.0 ± 0.2
VF	4000	0.757 to 0.793	0.0 ± 0.2
PROG	5000 5010	0.757 to 0.793	0.0 ± 0.2
PROG	15000	0.757 to 0.793	0.0 ± 0.2
PROG	20000	0.732 to 0.821	0.0 ± 0.5
WB	20000	0.346 to 0.388	0.0 ± 0.5

9.5.7 Transmit Impedance

(1) Press SETUP and change Interface type to 2W and transmit impedance (TX IMP) to 600 ohms.

(2) Press TEST and SEND.

(3) With a DMM terminated properly, verify the transmit level to be within tolerances (see table).

(4) Press SETUP and change TX IMP to 900 ohms and press PREV to return to the test. Verify DMM reading per table.

(5) Repeat for 1200 and 150 ohm transmit impedance.

(6) Press SETUP and change Interface type to WB (wideband) and the transmit impedance (TX IMP) to 135 ohms. Press PREV to return to the test. Verify DMM reading per table.

5200 Transmit Impedance	DMM Shunt Resistor	DMM Reading (Vac)	(dBm)
600 ohms	600 ohms	0.757 to 0.793	0.0 ± 0.1
900 ohms	900 ohms	0.937 to 0.967	0.0 ± 0.1
1200 ohms	1200 ohms	1.081 to 1.109	0.0 ± .01
150 ohms	150 ohms	0.378 to 0.403	0.0 ± 0.2
135 ohms	135 ohms	0.346 to 0.388	0.0 ± 0.5

9.5.8 Total Harmonic Distortion

(1) Connect 5200 XMT jack to 1710 input (600 ohm shunt termination).

(2) Select HUM (400 Hz) filter on the 1710.

(3) On the 5200, press SETUP and change the Interface type to VF4W and the transmit impedance (XMT IMP) to 600 ohms.

(4) Press TEST and select the LEVEL/FREQ test.

(5) Position the cursor under TX FREQ, using the left/right arrow keys.

(6) Select proper step size by the position of the cursor.

(7) Use the up/down arrow keys to tune the transmit frequency.

(8) For the frequencies shown, verify the THD readings per table.

(9) Press NEXT TEST and then press SETUP.

(10) Change the Interface type to PROG.

(11) Press TEST and select the LEVEL/FREQ test.

(12) Press SEND and verify THD readings at frequency shown.

(13) Press NEXT TEST and then SETUP.

(14) Change the Interface type to WB (wideband).

(15) Repeat test and verify THD readings at frequency shown.

5200 Transmit Band	Freq. (Hz)	1710 THD (dBm)
VF	100	< -40
VF	1004	< -50
VF	4000	< -40
PROG	5000 5010	< -40
WB	20000	< -40

9.5.9 Transmit Quiet Termination

(1) On 5200, press SETUP and select Interface type as VF4W and transmit impedance as 600 ohms.

(2) Press TEST and select the NOISE test.

(3) Measure the transmit output level on the 1710. It should be <-70 dB volts with HUM and 30 kHz noise filters selected.

9.5.10 Receive Level

(1) Set the 1710 output at 1004 Hz with the output impedance at 600 ohms.

(2) With a DMM, verify that 1720 output at 0.0 dBm is 1.54919 + 0.01 Vac.

(3) Press NEXT TEST and select the LEVEL/FREQ test.

(4) Connect the output of the 1710 to the 5200 RCV jack. Change the 1710 output level and verify the receive level displayed is within tolerances.

1710 Output (dBm)	5200 Receive Level (dBm)
+10.0	+10.0 ± 0.2
0.0	0.0 ± 0.1
-10.0	-10.0 ± 0.1
-20.0	-20.0 ± 0.1
-30.0	-30.0 ± 0.2
-40.0	-40.0 ± 0.2
-50.0	-50.0 ± 0.3
-60.0	-60.0 ± 0.5

9.5.11 Receive Impedance

(1) Connect the output of Fluke 5200A (with series termination) to the RCV jack of the 5200.

(2) Set proper voltage on Fluke 5200A per table below.

(3) Press SETUP on CXR 5200 and select Interface type as VF2W, impedance as 600 ohms, and Bridge/Term as BRDG.

(4) Press TEST and then select LEVEL/FREQ.

(5) Verify the receive level displayed on the CXR 5200 is per table below.

(6) Press SETUP and change impedance to 900 ohms and Bridge/Term to TERM.

(7) Press PREV to return to the test.

(8) Select proper voltage and termination on Fluke 5200 and verify results.

(9) Press SETUP and change Bridge/Term to TERM.

Fluke Output (Vac)	Fluke Series Impedance	CXR 5200 Receive Impedance Selection	CXR 5200 Receive Level (dBm)
1.54919	600	600 BRDG	6.0 ± 0.2
1.89737	900	900 TERM	0.0 ± 0.2
1.89737	900	900 BRDG	6.0 ± 0.2
2.19089	1200	1200 TERM	0.0 ± 0.2
2.19089	1200	1200 BRDG	6.0 ± 0.2
0.774597	150	150 TERM	0.0 ± 0.2
0.774597	150	150 BRDG	6.0 ± 0.2
0.734847	135	135 TERM	0.0 ± 0.5
0.734847	135	135 BRDG	6.0 ± 0.5

9.5.12 Receive Frequency Response

(1) Set the output of the Fluke to 1.54919 Vac (with series 600 ohms).

(2) On the CXR 5200, press SETUP and select Interface type as VF4W, receive impedance as 600 ohms, and Term/Bridge as TERM.

(3) Press TEST and then LEVEL/FREQ.

(4) Connect the Fluke output to the CXR 5200 RCV jack.

(5) Change the Fluke frequency and verify that the CXR receive level displayed is flat.

(6) Press SETUP and change the Interface type to PROG.

(7) Press TEST and verify that the CXR 5200 receive level for each frequency setting.

(8) Change the output of the Fluke to 0.73484 Vac (with series 135 ohms).

(9) On the CXR 5200, press SETUP and change the Interface type to WB and the Impedance to 135 ohms.

(10) Press TEST and verify receive level for 20000 Hz and 110000 Hz.

(11) Disconnect the Fluke from the 5200 and loop the CXR XMT and RCV jacks.

(12) Tune to 195000 Hz and verify the receive level.

CXR 5200 Frequency Band	Fluke Frequency (Hz)	CXR 5200 Receive Level (dBm)
VF	50	0.0 ± 0.5
VF	200	0.0 ± 0.2
VF	4004	0.0 ± 0.2
PROG	4004	0.0 ± 0.2
PROG	10000	0.0 ± 0.2
PROG	20000	0.0 ± 0.5
WB	20000	0.0 ± 0.5
WB	110000	0.0 ± 0.5
WB	195000	0.0 ± 1.0

9.5.13 Receive Frequency Measurement

(1) Set the output of the Fluke to 1.54919 Vac (with series 600 ohms).

(2) On the CXR 5200, press SETUP and select Interface type as VF4W, receive impedance as 600 ohms, and Term/Bridge as TERM.

(3) Press TEST and then LEVEL/FREQ.

(4) Connect the Fluke output to the CXR 5200 RCV jack.

(5) Change the Fluke frequency and verify that the frequency displayed on the CXR 5200 is within specifications.

(6) Press SETUP and change the Interface type to PROG.

(7) Press TEST, then LEVEL/FREQ, and verify the CXR 5200 frequency reading.

(8) Repeat steps 6 and 7 for WB.

Test Band	Fluke Frequency (Hz)	CXR 5200 Receive Frequency (kHz)
VF	50	0.050 ± 0.001
VF	4000	4.000 ± 0.001
PROG	4000	4.00 ± 0.01
PROG	20000	20.00 ± 0.01
WB	20000	20.0 ± 0.1
WB	110000	110.0 ± 0.1
WB	199000	199.0 ± 0.1

9.5.14 Receive Noise Measurement

(1) Set the 1710 at 0.0 dBm and 1200 Hz. Connect it to the CXR 5200 RCV jack.

(2) On the CXR 52000, press SETUP and select Interface type as VF4W, receive impedance as 600 ohms, and Term/Brdg as TERM.

(3) Press TEST and select NOISE .

(4) Press NOTCH.

(5) For each setting of the 1710, verify the CXR C-notch and 3 kHz-notch results as shown below.

(6) Change the 1710 output frequency to 1004 Hz.

(7) Press QUIET on the CXR 5200 to select idle noise, and verify the C-MSG and 3kHz results.

(8) Press SETUP and change the Interface type to PROG.

(9) Press TEST and select NOISE.

(10) For each setting of the 1710, verify the PROG weighted and PROG flat results as shown below.

(11) Press SETUP and change the Interface type to WB, receive impedance to 135 ohms.

(12) Connect the output of the Fluke 5200 to 0.73484 Vac (with series 135 ohms) to the CXR 5200 RCV jack.

(13) Press TEST and select NOISE on the CXR 5200..

(14) For each setting of the Fluke, verify the CXR 5200's wideband weighted results as shown below.

1710 Fluke (dBm)	VF Filters (dBrn)	Program (dBrn)	Wideband (dBrn)
0.0	90 ± 1	90± 1	90 ± 1
-10.0	80 ± 1	80± 1	80 ± 1
-20.0	70 ± 1	70± 1	70 ± 1
-30.0	60 ± 1	60± 1	60 ± 1
-40.0	50 ± 1	50± 1	50 ± 1
-50.0	40 ± 1	40± 1	40 ± 1
-60.0	30 ± 1	30± 1	30 ± 1
-70.0	20 ± 1	20± 2	
-80.0	10 ± 2		

9.5.15 Notch Filter

(1) On the CXR 5200, press SETUP and select the Interface type as VF4W, the receive impedance as 600 ohms, and Term/Bridge as TERM.

(2) Press TEST and select NOISE.

(3) Connect the output of the 1710 at 0.0 dBm and 1004 Hz to the CXR 5200 RCV jack.

(4) Change the 1710 frequency between 1004 Hz, 995 Hz, and 1025 Hz, and verify the results 0n the CXR 5200.

1710 Frequency (Hz)	C-Notch (dBrnC)	3K Notch (dBrn)	S/N Ratio (dB)
1004	<40	<40	>50
995	<40	<40	>50
1025	<40	<40	>50

9.5.16 Noise to Ground

(1) Set the 1710 at 0.0 dBm and 1004 Hz.

(2) Short Tip and Ring of the CXR 5200 RCV jack and connect it to one end of the balanced output of the 1710.

(3) Connect the other output of the 1710 to the S/G terminal on the CXR 5200.

(4) On the CXR 5200, press SETUP and select Interface type as VF2W , impedance as 600 ohms, and Term/Bridge as TERM.

(5) Press TEST and then select NOISE.

(6) Press NTG.

(7) Verify that both CMSG-N/G and 3K-N/G read 90 +2 dBrn(C).

9.5.17 Receive Filter Characteristics

(1) On the CXR 5200 VF2W Noise results screen in step (7) above, press BAL to return to a balanced reading.

(2) Keeping the level at 0.0 dBm on the 1710, change its frequency and verify C-MSG and 3 kHz-Flat results on the CXR 5200.

(3) Press SETUP and change Interface type to PROG. (Keep impedance at 600 ohms and Term/Bridge at TERM..)

(4) Press TEST and select NOISE.

(5) For each setting of the 1710, verify the program weighted and program flat results as shown below.

(6) Press SETUP and change the Interface type to WB, the receive impedance to 135 ohms. (Keep Term/Bridge at TERM.)

(7) Set the output of the Fluke 5200 to 0.73484 Vac (with series 135 ohms) and connect to the CXR 5200 RCV jack.

(8) On the CXR 5200, press TEST and select NOISE.

(9) For each setting of the Fluke, verify the wideband weighted results as shown below.

1710 Frequency (Hz)	CMSG Filter (dBrnC)	3kHz Filter (dBrn)	PROG Weighted (dBrn)	PROG Filter (dBrn)	WB Weighted (dBrn)
200	65 ± 3				
400	78 ± 1	90 ± 1	81 ± 2	90 ± 1	
1000		90 ± 1	90 ± 1	90 ± 1	90 ± 1
3000	87 ± 1	87 ± 1	96 ± 2		
5000		76 ± 2			
8000			94 ± 4		
10500			82 ± 4		
15000			68 ± 4	87 ± 2	
28000					87 ± 3
35000					85 ± 2

9.5.18 Return Loss -- 4 Wire

(1) On the CXR 5200-17, press SETUP and select Interface type as VF4W, receive impedance as 600 ohms, and Term/Bridge as TERM.

(2) Press TEST and then select RTN LOSS.

(3) Set up the CXR 704 as 600 ohms, terminated.

(4) Connect the XMT jack of the CXR 5200-17 to the RCV jack of the CXR 704.

(5) Verify that the 704 RCV level is -10 + 1 dBm.

(6) Disconnect the 704 and loop back the CXR 5200-17 XMT to its RCV.

(7) Verify that the CXR 5200-17 results read as follows:

ERL	SRLL	SRLH
0 ± 2	0 ± 2	0 ± 2

9.5.19 Return Loss -- 2 Wire

(1) On the CXR 5200-17, press SETUP and select Interface type as VF2W, receive impedance as 900 ohms, and Term/Bridge as TERM.

(2) Press TEST and then select RTN LOSS.

(3) Set up the CXR 704 as 900 ohms, terminated.

(4) With the XMT jack of the CXR 5200-17 connected to the RCV jack of the CXR 704 , verify that the 704 RCV level is -10 + 1 dBm for ERL, SRLL, and SRLH.

(5) Verify that the CXR 5200-17 results read as shown below.

(6) Bridge terminate the 704 RCV and verify readings on the CXR 5200-17 as shown below.

704 Receive Impedance	5200-17 Display ERL	SRLL	SRLH
900 TERM	28 ± 3	19 ± 3	36 ± 3
900 BRDG	0 ± 1	0 ± 1	0 ± 1

9.5.20 Impulse Noise

(1) Set up the Bradley in EXT TONE mode. Set the 1710 to 0.0 dBm, 1004 Hz. Connect the output of the 1710 to the EXT TONE input of the Bradley.

(2) On the Bradley, set all switches except IMP to the OFF position.

(3) Connect the output of the Bradley to the CXR 5200-17 RCV jack.

(4) Set the Bradley IMP LEVEL to 50 dBrn and SINGLE (push to send mode).

(5) On the CXR 5200-17, press SETUP and change Interface type to VF4W.

(6) Press TEST and select IMP NOISE.

(7) Press SETUP and set IMPULSE THRESH to 51 dBrn.

(8) Press TEST and then START.

(9) Press the impulse switch on the Bradley a few times and verify that all counters (IMP, IMP+4, and IMP+) on the CXR 5200-17 remain at zero.

(10) Change the Bradley impulse level to 52 dBrn.

(11) Press the impulse switch on the Bradley a few times. IMP+4 and IMP+8 on the CXR 5200-17 should still read zero, but IMP should have registered each time the Bradley impulse switch was pressed.

(12) Change the Bradley impulse level to 56 dBrn.

(13) Press the impulse switch on the Bradley a few times. On the CXR 5200-17, IMP+8 should still read zero, but IMP+4 should have registered each of the impulses.

(14) Change the Bradley impulse level to 60 dBrn.

(15) Press the Bradley impulse switch a few times. The CXR 5200-17 IMP+8 should now register each of the impulses.

Note:

If the Bradley is not available, test Impulse Noise as follows:

(1) On the CXR 5200-17, set IMPULSE THRESH to 60 dBrn.

(2) Set the output of the 704 at 1004 Hz, 0.0 dB.

(3) Connect the 704 output to the 5200-17 RCV jack.

(4) Select IMP NOISE and START on the 5200-17.

(5) Verify that all 5200-17 counters read zero.

(6) Change the output of the 704 to -40 dBm.

(7) Change the 704 frequency to 1200 Hz.

(8) Verify that all 5200-17 counters still read zero.

(9) Change 704 output to -30 dBm.

(10) Verify that the 5200-17 counters begin registering the impulses.

9.5.21 P/AR

(1) Press NEXT TEST and select PA/R

(2) Loop back the CXR 5200-17 XMT jack to the RCV jack.

(3) Verify that the 5200-17 reads 100 ± 2 units.

9.5.22 Speaker Operation

(1) Press NEXT TEST and select LEVEL/FREQ.

(2) Loop back the XMT jack to the RCV jack.

(3) Turn the volume knob clockwise and verify an increase in loudness with no breakup.

(4) Return the volume pot to its minimum position.

9.5.23 Holding Circuits
(This test is to be performed only if OPT A is not installed.)

(1) Press SHIFT and MAIN to return to the main screen.
(2) Select DIAL and press OFF HOOK key to go off hook.
(3) Connect the 48 Vdc supply (with 600 ohms and an ampmeter in series) to the 5200-17 XMT jack.
(4) Verify that the current drain is 23 ± 2 mA.
(5) Press ON HOOK.

9.5.24 Dial and Talk
(This test is to be performed only if OPT A is not installed.)

(1) Press SETUP and change the DIGIT TYPE to DTMF.
(2) Connect a phone line to the 2W/4W RJ11 connector.
(3) Press TEST.
(4) Press OFF HOOK and enter the telephone number from the keypad.
(5) When the dialed telephone rings, answer it.
(6) Connect a butt set to the terminals labeled TEL SET.
(7) Talk into the butt set to verify that it can be heard at the other telephone.
(8) Press ON HOOK.
(9) Press SETUP and change DIGIT TYPE to DP.
(10) Press TEST.
(11) Press OFF HOOK and enter telephone number from the keypad.
(12) Verify that the dialed telephone number rings.
(13) Press ON HOOK.
(14) Disconnect the telephone line from the CXR 5200-17.
(15) Go to SETUP and change DIGIT TYPE back to DTMF.

9.5.25 Back Light

(1) Toggle back light on and off by pressing SHIFT and BACKLIGHT.
(2) Verify that the backlight turns on and off.
(3) Turn back light on.

9.5.26 Contrast Control

(1) Turn the contrast knob and verify that the contrast on the LCD changes.

9.5.27 Printer

(1) Connect a parallel printer (Epson FX-86E or equivalent) to the printer port on the CXR 5200-17.

(2) Press SHIFT and PRINT and verify that the information on the LCD screen is printed out.

9.5.28 Real Time Clock

(1) Press SHIFT and MAIN to return to the main screen.

(2) Verify that the time, date, month, and year are displayed and are correct .

9.5.29 Battery Operation

(1) Turn on the CXR 5200-17, disconnect the power cord, and verify that it continues to operate properly.

(2) Reconnect the power cord to the CXR 5200-17.

9.5.30 Nonvolatile Memory

(1) Press TMS and then SETUP.

(2) Change the Interface type to VF4W.

(3) Loop back the 5200-17 XMT jack to the RCV jack.

(4) Press TEST and select LEVEL/FREQ.

(5) Press SAVE.

(6) Go to main screen by pressing SHIFT and MAIN.

(7) Select UTLY.

(8) Select RESULTS FILE and VIEW.

(9) Verify that the LEVEL/FREQ results are displayed on the screen.

(10) Power down and power up the 5200-17.

(11) Go back to UTLY and select RESULTS FILE and VIEW.

(12) Verify that the LEVEL/FREQ results are still displayed on the screen.

(13) Press CLEAR to erase the stored results.

9.5.31 Envelope Delay Distortion

(1) Press SETUP and select Interface type as VF4W.

(2) Press TEST and select ENV DELAY.

(3) Press SETUP and change tuning to MAN (manual) and EDD mode to MASTER.

(4) Loop back the CXR 5200-17 XMT to RCV.

(5) Press TEST and then RET REF.

(6) Wait until readings settle and the delay reads "0".

(7) Press MORE, then SET 0 REF, then MORE again. Verify that the loss reads "0".

(8) Press STEP for next frequency and verify the results at the following frequencies.

FREQ (Hz)	DELAY (µsec)	LOSS (dB)
304	< 40	0.0 ± 0.2
1004	< 5	0.0 ± 0.2
804	< 5	0.0 ± 0.2

9.5.32 Phase and Amplitude Jitter

(1) Press NEXT TEST and select PHS/AMP JTR.

(2) With the CXR 5200 XMT looped back to its RCV, verify the following:

RCV LVL = 0.0 ± 0.2
RCV FREQ = 1004 ± 2
PH JTR (STD) = 0.0 ± 0.2
PH JTR (STD+LF) = 0.0 ± 0.2

(3) Connect the CXR 5200 XMT to the external tone input of the Bradley 2A.

(4) Connect the output of the Bradley to the 5200 RCV.

(5) On the Bradley, set the following:

All toggle switches to OFF.
Signal Source knob in the EXT INPUT mode.
Output impedance to 600 ohms.
Output level to 0 dB.

(6) Adjust the Bradley so that the CXR 5200 level reads 0.0 dBm.

(7) Set the Bradley Phase Modulation toggle switch to ON and vary the phase modulation knob to verify the following:

Bradley Phase Modulation (deg)	CXR 5200 Phase Jitter (deg)
10	10 ± 2
20	20 ± 2
30	30 ± 2
40	40 ± 3

(8) Set the Bradley Phase Modulation toggle switch to OFF.

(9) On the 5200, press AMP JTR.

(10) Set the Bradley Amplitude Modulation toggle switch to ON and vary the Amplitude Modulation knob to verify the following:

Bradley Amp Modulation (%)	CXR 5200 Amp Jitter (%)
10	10 ± 2
20	20 ± 2
30	30 ± 2
40	40 ± 3

(11) Set the Bradley Amplitude Modulation toggle switch to OFF.

9.5.33 Hits

(1) On the CXR 5200, press NEXT TEST and select IMP/HITS.

(2) Connect 5200 XMT to the external tone input of the Bradley 2A.

(3) Connect the output of the Bradley to the 5200 RCV.

(4) On the Bradley, set the following:

All toggle switches to OFF.
Signal Source knob in the EXT INPUT mode.
Output impedance to 600 ohms.
Output level to 0 dB.
Hit interval to 1 second and CONTINUOUS mode (not push-to-send mode)
Hit rise time to 1 ms (10 x 0.1)
Hit duration to 100 ms (100 x 1)

(5) Verify that the "Repetitive Hits" lamp on the Bradley is lit.

(6) On the 5200, press SETUP and select:

PHASE THRESH = 25 deg
GAIN THRESH = 2 dB

(7) Press TEST and then START.

(8) The 5200 will display the hits results. Verify the following:

RCV LVL = 0.0 ± 0.2
RCV FREQ = 1004 ± 2
GN HITS = 0
PH HITS = 0
DRP OUTS = 0

(9) On the Bradley, set the "Gain Ampl" knob to zero (0) and switch the "Gain Hit" toggle switch to ON.

(10) Turn the "Gain Amp" knob to 1.0 and verify that the GN HITS counter on the 5200 remains at zero (0). Turn the knob to 3.0 and verify that the 5200 continuously registers gain hits.

(11) On the Bradley, set the "Gain Hits" toggle switch to OFF, set the "Phase Ampl" knob to zero, and set the "Phase Hit" toggle switch to ON.

(12) Turn the "Phase Ampl" knob to 20 and verify that the PH HITS counter remains at zero. Turn the knob to 30 and verify that the 5200 continuously registers phase hits.

(13) Set the "Phase Hits" toggle switch to OFF, set the "Gain Ampl" knob to zero, and set the "Gain Hit" toggle switch to ON.

(14) Turn the "Gain Ampl" knob to 11 and verify that DRP OUTS counter remains at zero (gain hits will count). Turn the "Gain Ampl" knob to 13 and verify that the 5200 continuously registers drop outs (gain hits will stop counting).

(15) Set the "Gain Ampl" knob to zero and set the "Gain Hit" toggle switch to OFF.

9.5.34 Intermodulation Distortion (IMD)

(1) Connect the CXR 5200 XMT to the external tone input of the Bradley 2A.

(2) Connect the output of the Bradley to the 5200 RCV.

(3) On the Bradley, set the following:

All toggle switches to OFF.
Signal Source knob in the EXT INPUT mode.
Output impedance to 600 ohms.
Output level to 0 dB.

(4) On the CXR 5200, press NEXT TEST and select IMD.

(5) Verify that the 5200 measures >55 dB for both 2nd and 3rd IMD.

(6) Set the transmit level of a CXR 704 at -10 dB and 520 Hz, and then superimpose the signal on the output of the Bradley.

(7) Change the 704 transmit level and verify that the CXR 5200 reads as follows:

704 Transmit (dBm)	CXR 5200 2nd IMD (dB below)
-10	10 ± 1
-20	20 ± 1
-30	30 ± 1
-40	40 ± 2

(8) Set the CXR 704 transmit to 0.0 dB and 520 Hz.

(9) On the Bradley, set the following:

Output level to -10 dB.
Tone Freq. to 1900 Hz
Signal Source to internal generation

(10) Change the Bradley output level and verify the following readings on the CXR 5200.

Bradley Transmit (dBm)	CXR 5200 3rd IMD (dB below)
-10	10 ± 1
-20	20 ± 1
-30	30 ± 1
-40	40 ± 2

9.6 Calibration Procedures

The Model 5200-17 is shipped calibrated from the factory. Thereafter, these procedures should be performed at a minimum of 12 month intervals.

9.6.1 Required Test Equipment and Tools

(1) Fluke 8810 DMM or equivalent

(2) Sound Technology 1710 or equivalent

(3) Fluke 5200-17A or equivalent

(4) 135 ohms series impedance

(5) CXR 704A2 or equivalent

(6) 310 to double banana cable

(7) 310 to 310 cable

(8) Maxigrabber Test Clip (ITT Pomona) P/N 4225-0 6" long
Contact Allied Electronics Allied P/N 885-4225-2 ph (619) 279-2550.

(9) Clipper Test Clip
Mueller Type 20412 5.5" long Newark Electronics ph (619) 431-2711.

9.6.2 Set Real Time Clock

(1) Press UTLY on Main Menu.

(2) Mover cursor to DATE AND TIME and press SELECT.

(3) Mover cursor and enter new date and time.

(4) Press EXIT twice to return to main screen.

9.6.3 Calibrate VF Receiver

Turn off power; remove the jumper from JP-1 on the Main Board; insert the jumper on E-3 of Analog Board then turn on the power. Press "*" to skip self-test. Proceed with calibration. After calibration, remove E-3 jumper and replace back to JP-1 on Main Board. **CAUTION. Never shut down or turn off the unit while the jumper is still in E-3 or all the calibration data will be lost.**

Use the Maxigrabber "Plunger Type" test clip (or any suitable long tip type forcep) to remove or replace the JP-1 jumper.

(1) Press 'TMS'

(2) With the cursor at 'LEVEL/FREQ', press 'SETUP'

(3) On the Set Up screen change

INTERFACE	: VF 4W
BRIDGE/TERM	: TERM
TX LEVEL	: 0.0 dBm
RX TLP	: 0 dB
TX IMPEDANCE	: 600 ohms
RX IMPEDANCE	: 600 ohms

(4) Press 'TEST' to go to the LEVEL/FREQ test.

(5) Set the output of 1710 at 0.0 dBm, 1004 Hz and 600 ohms output impedance.

(6) With a DMM verify the output of 1710 to be 1.54919 +/- 0.01 Vac.

(7) Connect output of 1710 to 5200-17 RCV 310.

(8) Observe the receive level displayed. If the receive level displayed is not 0.0 dBm, then it should be calibrated in the following manner.

(9) To enter Calibration mode, press 'SHIFT' '2'.

(10) Display will show ENTRY :

(11) Enter the 4 digit value of the location that needs to be calibrated. (Refer to Table-5)

(12) Display will show
READ : xxxx (where xxxx is present value in EEROM)
ENTER :

(13) Compute the correction required in 'hex' and enter the 4 digit correction.

(14) To exit calibration press 'SHIFT' '2'.

example-1

If the level displayed was -0.5 dBm instead of 0.0 dBm, then the correction required is computed as follows:

C=10(DELTA) hex

where DELTA is the value of (TRUE VALUE-DISPLAY VALUE)

So, if the displayed value was -0.5 dBm and the true value should be 0.0 dBm, then

DELTA = { 0.0 - (-0.5)}
= 0.5

Then C = 10 (0.5)
= 5 decimal
= 5 hex

The value to be entered is (xxxx + C)

So, if xxxx was 'FFFF' then enter (FFFF+5)=0004.

example-2

If the level displayed was -12.8 dBm instead of -14.0 dBm, then the correction required is computed as follows:

DELTA = { -14.0 - (-12.8)}
= -1.2

Then C = 10 (-1.2)
= -12 decimal
= FFF4 hex

The value to be entered is (xxxx + C)

So, if xxxx was 'FFFF' then enter (FFFF+FFF4)=FFF3.

Table-1

5200-17 Test Selection	1710 Output (dBm)	1710 Output Frequency (Hz)	5200-17 Results Display	Entry (hex)
VF-LEVEL/FREQ	+10.0	1004	+10.0 dBm	0000
VF-LEVEL/FREQ	0.0	1004	0.0 dBm	0001
VF-LEVEL/FREQ	-14.0	1004	-14.0 dBm	0002
VF-LEVEL/FREQ	-27.0	1004	-27.0 dBm	0003
VF-LEVEL/FREQ	-34.0	1004	-34.0 dBm	0004
VF-LEVEL/FREQ	-50.0	1004	-50.0 dBm	0005
NOISE(CMSG)	0.0	1004	90 dBrnC	0006
NOISE(CNOTCH)	0.0	1204	90 dBrnC	0007
NOISE(3k FLT)	0.0	1004	90 dBrn	0008
NOISE(3kNOTCH)	0.0	1204	90 dBrn	0009

9.6.4 Calibrate Noise-to-Ground

(1) Press SETUP and change
INTERFACE : VF2W
BRIDGE/TERM : TERM
IMPEDANCE : 600 ohms

(2) Disconnect the 1710 output from the RCV 310

(3) Short TIP and RING of the XMT 310 and connect it to one of the outputs of the 1710.

(4) Connect the other output of 1710 to the S/G terminal.

(5) Press TEST and SELECT the NOISE test.

(6) Press NTG and calibrate tests listed in Table-2

Table-2

5200-17 Test Selection	1710 Output Level (dBm)	1710 Output Frequency (Hz)	5200-17 Results Display	Entry (hex)
NTG-CMSG	0.0	1004	90 dBrn	000A
NTG-3k FLT	0.0	1004	90 dBrn	000B

9.6.5 Calibrate Program Band Receiver.

(1) Press SETUP and change
INTERFACE : PROG
BRIDGE/TERM : TERM
IMPEDANCE : 600 ohms

(2) Disconnect the cable from the 5200-17 RCV 310 to the 1710.

(3) Connect the output of 1710 to the XMT 310 of the 5200-17

(4) Press TEST and SELECT the LEVEL/FREQ test and calibrate as in Table-3.

(5) Press NEXT TEST and SELECT the NOISE test and calibrate as in Table-3.

Table-3

5200-17 Test Selection	1710 Output Level (dBm)	1710 Output Frequency (Hz)	5200-17 Results Display	Entry (hex)
PROG-LEVEL/FREQ	0.0	5004	0.0 dBm	0010
20KHz-WTD	0.0	1004	90 dBrn	000D
20KHz-FLAT	0.0	1004	90 dBrn	000C

9.6.6 Calibrate Wide Band Receiver

(1) Press SETUP and change
INTERFACE : WB
BRIDGE/TERM : TERM
IMPEDANCE : 135 ohms

(2) Disconnect all cables from the 5200-17 and the 1710.

(3) Connect the output of Fluke 5200-17(with 135 ohms series termination) to the RCV 310 of the 5200-17.

(4) Press TEST and SELECT the LEVEL/FREQ test and calibrate as in Table-4.

(5) Press NEXT TEST and SELECT the NOISE test and calibrate as in Table-4.

Table-4

5200-17 Test Selection	Fluke 5200-17 Output Level (dBm)	Fluke 1710 Frequency (Hz)	5200-17 Results Display	Entry (hex)
WB-LEVEL/FREQ	0.734847	20.0	0.0 dBm	0011
50KHz-WTD	0.734847	1.0	90 dBrn	000E

9.6.7 Calibrate VF Transmitter

(1) Press SETUP and change
INTERFACE : VF 4W
TX LEVEL : 0.0 dBm
TX IMPEDANCE : 600 ohms

(2) Set the output of 1710 at 0.0 dBm and 1004 Hz. (600 ohms)

(3) Set up the 704 display to LEVEL and
TRMT/RCV : RCV
RCV IMP : 600
TERM/BRDG : TERM
4kHz/110kHz/20kHz : 4kHz

(4) Connect the output of 1710 to 704 RECEIVE 310 and verify that the 704 displays 0.0 dBm.

(5) Disconnect the 1710 from the 704.

(6) Connect the XMT 310 of the 5200-17 to the RECEIVE 310 of the 704.

(7) On the 5200-17 press TEST and SELECT the LEVEL/FREQ test.

(8) Based on the value displayed on the 704 the 5200-17 Transmitter may need to be calibrated using the following procedure.

(9) To enter Calibration mode, press 'SHIFT' '2'.

(10) Display will show
ENTRY :

(11) Enter the 4 digit value of the location that needs to be calibrated. (Refer to Table-5)

(12) Display will show
READ : xxxx (where xxxx is present value in EEROM)
ENTER :

(13) Compute the correction required in 'hex' and enter the 4 digit correction.
example-1
If the level displayed on the 704 was -0.5 dBm instead of 0.0 dBm, then the correction is:
C=10(DELTA) hex
where DELTA is the value of (TRUE VALUE-DISPLAY VALUE)
So, if the displayed value was -0.5 dBm and the true value should be 0.0 dBm, then
DELTA = { 0.0 - (-0.5)}
Then C = 10 (0.5)
= 5 hex
The value to be entered is (xxxx + C)
So, if xxxx was 'FFFF' then enter (FFFF+5)=0004.

(14) Verify entry by repeating Step11.

(15) Press 'SHIFT' '2' to exit calibration mode.

(16) For calibration to be effective, exit and re-enter test by pressing NEXT TEST and PREV

(17) Once back in Test mode, verify that the display is within tolerance.

(18) Use left/right and up/down cursor to change level and repeat for all levels listed in Table-5,6,7.

Table-5

5200-17 Test Selection	5200-17 XMT Level (dBm)	5200-17 XMT Frequency (Hz)	704RCV Level (dBm)	Entry (hex)
VF-LEVEL/FREQ	0.0	1004	0.0	0080
VF-LEVEL/FREQ	-13.0	1004	-13.0	0081
VF-LEVEL/FREQ	-30.0	1004	-30.0	0082

9.6.8 Calibrate Program Band Transmit

(1) Press SETUP and change
INTERFACE : PROG
TX LEVEL : 0.0 dBm
IMPEDANCE : 600 ohms

(2) Press TEST and SELECT the LEVEL/FREQ test.

(3) Set up the 704 as
4kHz/110kHz/20kHz : 20kHz

(4) Press TEST and SELECT the LEVEL/FREQ test.

(5) Press SEND and use left/right and up/down cursor to change the frequency to calibrate as in Table-6.

Table-6

5200-17 Test Selection	5200-17 XMT Level (dBm)	5200-17 XMT Frequency (Hz)	704RCV Level (dBm)	Entry (hex)
PROG-LEVEL/FREQ	0.0	5.10	0.0	0084

9.6.9 Calibrate Wideband Transmit

(1) Press SETUP and change
INTERFACE : WB
TX LEVEL : 0.0 dBm
IMPEDANCE : 135 ohms

(2) Set up the 704 as
RCV IMP : 135
TERM/BRDG : TERM
4kHz/110kHz/20kHz : 110 kHz

(3) Press TEST and SELECT the LEVEL/FREQ test.

(4) Use left/right and up/down cursor to tune the frequency and calibrate as in Table-7.

Table-7

5200-17 Test Selection	5200-17 XMT Level (dBm)	5200-17 XMT Frequency (Hz)	704RCV Level (dBm)	Entry (hex)
WB-LEVEL/FREQ	0.0	20.10	0.0	0085

9.6.10 Calibrate Hybrid Loss

(1) Press SETUP and change

INTERFACE	: VF 2W
BRIDGE/TERM	: TERM
TX LEVEL	: 0.0 dBm
RX TLP	: 0 dB
IMPEDANCE	: 900 ohms

(2) Set up the 704 as

RCV IMP	: 900
TERM/BRDG	: TERM
4kHz/110kHz/20kHz	: 4 kHz

(3) Press TEST and SELECT the RTN LOSS test.

(4) If the 704 RCV level is not -10.0 SYMBOL 43 \f "Symbol" / SYMBOL 45 \f "Symbol" 0.5 dB, then calibrate per Table-8.

Table-8

5200-17 Test Selection	704RCV Level (dBm)	Entry (hex)
2W-RTN LOSS	-10.0 / 0.5	0083

9.6.11 End Calibration

(1) Remove the jumper from E3 on the Analog board.

(2) Power down the 5200-17.

(3) Install the jumper at JP-1 on the Mother board.

10. TROUBLESHOOTING PROCEDURE

The troubleshooting procedure outlined in this section will assist an experienced technician in isolating a fault to a replaceable unit or Printed Circuit board. For component replacement (repair of a board), refer to the applicable test procedure, the schematic, and the appropriate parts lists.

Board level repair should not be attempted by inexperienced personnel or performed at locations where proper tools and instrumentation are not available.

General Procedure

The basic process of troubleshooting is outlined in the flow chart. Specific procedures referenced on the chart are detailed in the following sections as necessary.

Symptoms of a malfunction which are traced to a faulty unit in this section include the following:

- LCD remains dark
- Backlight OFF
- Speaker OFF
- Keypanel inoperative
- Generator/measurement functions operate incorrectly

Individual malfunctions may be the result of internal cables becoming disconnected. Items occurring in combination are more likely to be the result of board level or power supply failures.

10.1 Tracing Source of Specific Malfunction

The different types of faulty indications are traced as described in the following sections. Cable connections (identified in brackets) should always be checked first. MB demotes Main Board.

(1) LCD OFF

The most obvious malfunction is a dead display. This is generally caused by loss of power somewhere in the chain from batteries to the display unit. A *frozen* display results from a software error and is not typically the result of a physical failure.

The flow chart outlines the checking sequence. Detailed procedures are described in section 2. Cables to check include transformer cable to J1 on MB and battery charger connection J4 on MB.

(2) Backlight

Remove top of case to isolate and repair. Malfunction may be caused by:

- cable connections (J8 on MB)
- backlight power converter (PS2 on MB)

Measure 140 ± 10 VAC across J8-1/2 with cable terminated by LCD at other end. (Open circuit voltage is not controlled.)

- front panel control. Verify keypanel operation.

(3) Speaker Not Functional

This problem will more than likely be caused by defective circuitry (U64) on the MB. Other sources include:

- unseated/broken cable (J13, J10, or J12 on MB)
- faulty analog board (key response 'beep' is OK; test signal is not audible.)
- speaker itself

(4) Keypanel Malfunction
The Keypanel is divided into two groups of 20 keys. If no keys are operational, the common circuits are at fault. These include:
- scanner chip (U19, U26)
- cable (J7 on MB). The keypanel and cable are an integral assembly and should be handled carefully.

(5) Generate/Measurement Function Impaired
The Main Board Self Check (Main Menu/Utilities) will locate many types of faults. Each test is listed as it executes with an OK/bad indication.

If the self check passes, conduct a back-to-back test to verify operation of analog interface circuitry.
- patch Transmit (Output) to Receive (Input)
- select Level; 4W Interface
- check that receiver measures same level and frequency set by transmitter. Refer to test procedure to conduct detailed verification and fault isolation.

Some faults can be checked only with the use of external test equipment.

10.2 Repair Procedure

Removal of the top cover provides access to the interunit cables and some voltage test points. The power transformer is mounted to the side panel but the *rear* panel must be removed for troubleshooting this component. Removable of top, bottom, and rear panels is necessary in order to replace PCBs.

Caution: Disconnect power cord from AC outlet during case disassembly and assembly operations.
Observe proper ESD procedures when working on open unit.
Follow normal safety practices when working on open set which is powered from AC supply. ***117 VAC can be lethal!***

(1) Inter-unit Cables
Remove top cover (six screws, top and sides).
Check internal cable connections on MB

Speaker: - J13
Backlight: - J8
LCD: - J4

(2) Power Transformer:
Remove rear panel to check power transformer. Procedure:

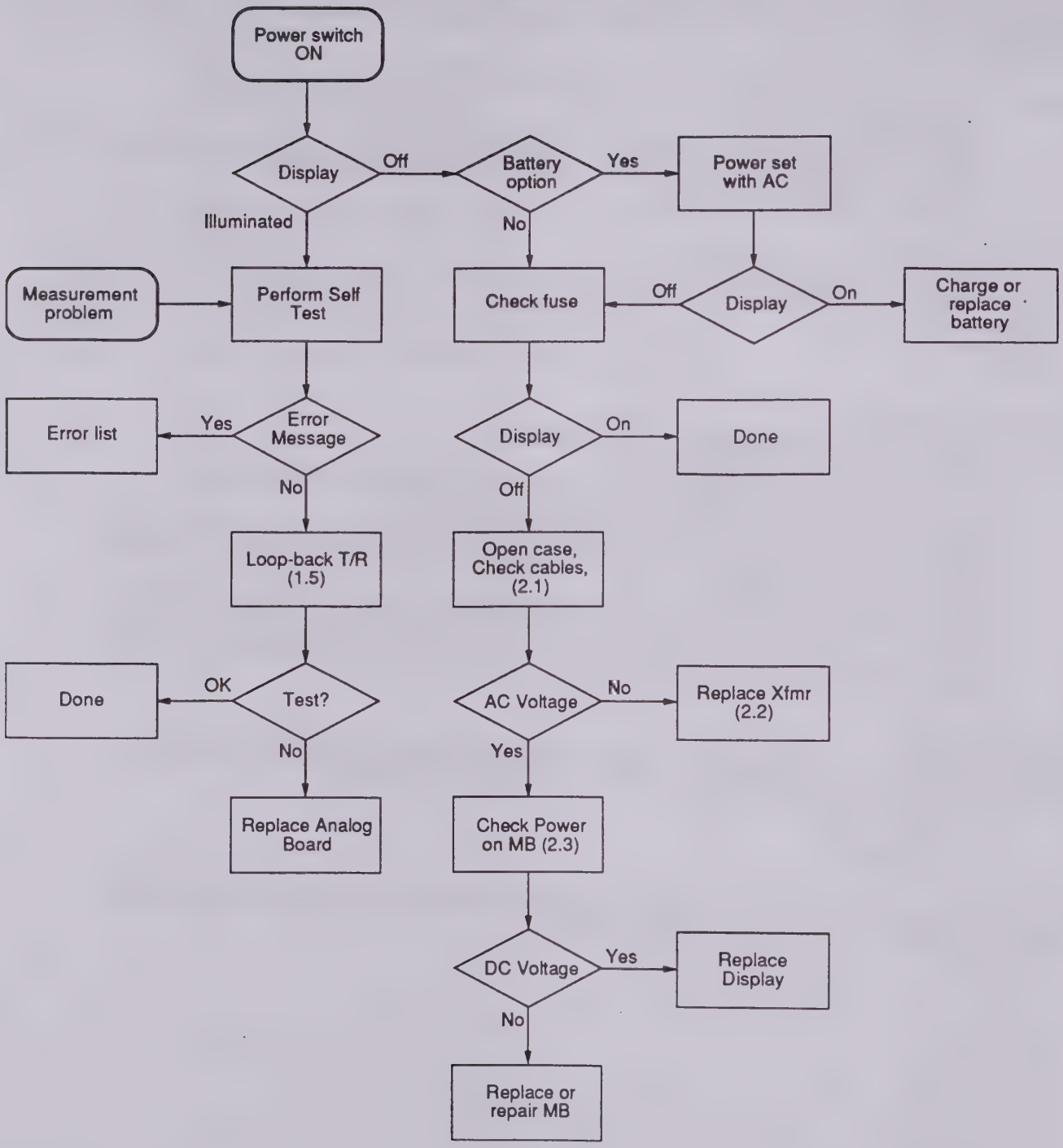
- remove four screws at corners of panel
- remove four HEX nuts which secure the 25-pair printer and RS-232C connectors
- remove screw which fastens battery hardware from side panel
- with panel removed from case, but all cables properly attached, power set from AC outlet.
- measure AC mains voltage across J1-3/5. (Expected reading is 117 VAC) If no reading is measured trace back to source of open.
- measure secondary voltage across T1-7/9 and T1-10/12. (Expected reading is 18 VAC in both cases.) No reading indicates an open in the secondary connection. Locate and rectify or replace transformer. A low reading may be the result of a short on the secondary side, or a defective transformer.

(3) Power Supply
Regulated output voltages are provided to operate electronic circuitry. Measure voltages with DVOM, with reference to GND (TP1–5, or PS1-4). Voltage tolerance is 5%.

- +12 VDC: PS1-3
- – 12 VDC: PS1-5
- + 5 VDC: PS1-6

If LCD is non-operational, check +5 V supply at display unit itself. If backlight is not functional, check +5 V supply to converter and converter noise.

Figure 10-1
Troubleshooting Procedure



COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

EMBLY: 18-55200-170 5200-17 FINAL ASSY (NAVY)

PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
00131-800	CONTROL MASTER PRODUCTS INC	26923	SPECIAL	33.25
50005-080	CXR	42161		13.44
50020-310	CXR	42161		2.40
50800-380	CXR	42161		101.25
55200-220	CXR	42161		64.19

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 21-55200-170 BASIC ASSY,5200-17

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
31-00067-010	PANASONIC	2M734	PKR-4400D	36.05
33-00282-010	POWER DYNAMICS	60046	19195(PREFERRED)	2.24
37-00011-010	CXR	42161		2.70
42-00268-020	3M	0ESF3	4504-1/2"	
44-50801-310	CXR	42161		6.66
44-55200-031	CXR	42161		
44-55200-050	CXR	42161		9.10
44-55200-061	CXR	42161		
44-55200-071	CXR	42161		234.25
44-55200-100	CXR	42161		32.62
53-00052-080	PRO FASTENERS	0RAW5	RA853	
53-00148-050	PRO FASTENERS	0RAW5	P-537-M06-F12-632	0.80
53-00148-260	PRO FASTENERS	0RAW5	P-561-M06-F12-632	1.20
53-00170-030	PRO FASTENERS	0RAW5	4542-632-A-7	2.40
53-00170-040	PRO FASTENERS	0RAW5	4536-632-A-7	1.60
53-00195-010	ALATEC	79756	D110551	
54-00103-010	PHC INDUSTRIES		5400Z-615 HANDLE	13.30
54-00126-010	PRO FASTENERS	0RAW5	ABUP-1/8	0.20
54-00127-010	PRO FASTENERS	0RAW5	AD42H	0.24
54-00138-010	CXR	42161		7.78

COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

EMBLY: 23-55200-013 TSTD PC ASSY,MAIN BD,5200-17

PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
55200-050	CXR	42161		105.00
55200-060	CXR	42161		105.00
55200-071	CXR	42161		81.76
55200-081	CXR	42161		68.98
55200-090	CXR	42161		105.00
55200-101	CXR	42161		42.41
55200-111	CXR	42161		35.46
55200-120	CXR	42161		105.00
55200-190	CXR	42161		163.52

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 23-55200-019 PC ASSY, MAIN BD,5200-17

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
30-00233-030	ECLIPTEK	0GU66	PER SPEC.	5.84
30-00233-040	ECLIPTEK CORPORATION	0GU66	PER SPEC.	5.84
30-00295-010	ECLIPTEK CORPORATION	0GU66	CCO-711SS-4.91520	36.26
30-00295-030	CARDINAL	0C8T2	CCO-711SS-20.4800	42.00
30-00335-010	ECLIPTEK CORPORATION	0GU66	TCO-711SHC-4.608MHZ	42.00
30-00335-020	ECLIPTEK CORPORATION	0GU66	TCO-711SHC-13.0MHZ	42.00
30-00336-010	SIERRA WEST ELECTRONICS	0NDV6	RL-2250-56-28	75.32
33-00256-010	SCHURTER	61935	FMS 031.750L	4.48
33-00257-030	CXR	42161		6.00
34-00076-180	PANDUIT	06383	MLSR156-18	4.00
34-00085-140	BELL INDUSTRIES	4A884	65508-102	1.12
34-00195-020	BELL INDUSTRIES	4A884	65474-001	2.40
34-00220-020	DC ELECTRONICS SUPPLY	0HF75	65610-220	6.00
34-00235-020	HAMILTON/AVNET ELECTRON	0M8P2	MLSS156-2	0.48
34-00235-050	HAMILTON/AVNET ELECTRON	0M8P2	MLSS156-5	1.68
34-00235-080	HAMILTON/AVNET ELECTRON	0M8P2	MLSS156-8	1.28
34-00378-020	HAMILTON/AVNET ELECTRON	0M8P2	ICO-243-S8-T	0.96
34-00378-030	CIRCUIT ASSEMBLY	52072	CA-28SDL-1T-3	2.40
34-00390-010	AMP	18342	821574-1	5.92
34-00457-100	CIRCUIT ASSEMBLY	52072	CA-S15-23T-43	4.24
34-00464-070	RICHEY-CYPRESS ELECTRONICS	8V746	101-7282812	4.88
34-00464-080	BELL INDUSTRIES	4A884	32-6513-10	6.40
34-00464-100	BELL INDUSTRIES	4A884	101-7402812	7.92
34-00496-010	DC ELECTRONICS SUPPLY	0HF75	2-044-6232-060-38-77	10.50
34-00540-020	SIERRA WEST ELECTRONICS	0NDV6	SS-6446-50-FLS	6.16
34-00567-010	KENT ELECTRONICS	0EUK0	3764-5202	27.09
34-00653-010	HAMILTON/AVNET ELECTRON	0M8P2	821949-5	74.20
34-00653-020	HAMILTON/AVNET ELECTRON	0M8P2	821942-1	9.73
34-00661-010	AMP INC.	18342	745401-2	21.84
34-00662-010	HAMILTON/AVNET ELECTRON	0M8P2	745392-2	22.61
39-00055-030	ENDICOTT(ERG)		LPS05-3-4P	48.23
39-00062-010	CALEX		12T5.12SW	390.00
42-00048-010	CRAFT HOUSE CORP.		90101	
43-55200-011	CXR	42161		
44-55200-240	CXR	42161		33.95
44-55200-250	CXR	42161		9.80
46-00139-010	ACCESSORIES FOR ELEC	54355	C785B	1.44
53-00052-080	PRO FASTENERS	0RAW5	RA853	
53-00146-010	CONTROL DESIGN SUPPLY INC	76188	TP-102-01	0.28
60-05400-010	HAMILTON/AVNET ELECTRON	0M8P2	1N5400	1.12
60-05818-010	HAMILTON/AVNET ELECTRON	0M8P2	VSK130	1.12
61-00825-110	ARROW ELECTRONICS	0NKP6	1N825-5%	3.36
61-05822-010	HAMILTON/AVNET ELECTRON	0M8P2	VSK 340	3.44
63-03906-010	ARROW ELECTRONICS	0NKP6	2N3906	0.32
64-00102-010	BELL INDUSTRIES	4A884	3YVP-400L4	8.33
64-00120-030	VARO SEMICONDUCTOR	83003	VH248	7.76
65-00036-020	ARROW ELECTRONICS	0NKP6	LM317HVH(PREF.)	25.90
65-00046-010	ANTHEM ELECTRONICS	1H811	TL7705ACP	7.04
65-00111-010	HAMILTON/AVNET	0M8P2	MC34119P	4.80

COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

MBLY: 23-55200-019 PC ASSY, MAIN BD,5200-17

PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
0112-010	ARROW ELECTRONICS	0NKP6	LT1141N	23.80
0393-010	BELL INDUSTRIES	4A884	LM393P	1.60
7404-090	BELL INDUSTRIES	4A884	CD74AC04PC	2.16
4126-070	HAMILTON/AVNET	0M8P2	MC74BCT126N	5.36
4151-050	ARROW ELECTRONICS	0NKP6	US74HCT151N	1.76
4245-080	HAMILTON/AVNET ELECTRON	0M8P2	MC74ACT245N	4.72
4259-050	HAMILTON/AVNET	0M8P2	CD74HCT259E	2.80
4377-050	HAMILTON/AVNET ELECTRON	0M8P2	CD74HCT377E	2.16
4573-080	ARROW ELECTRONICS	0NKP6	CD74ACT573E	4.52
4595-040	HAMILTON/AVNET ELECTRON	0M8P2	SN74HC595N	6.00
4841-080	HAMILTON/AVNET ELECTRON	0M8P2	V74ACT841P	18.20
4922-030	BELL INDUSTRIES	4A884	MM74C922N	22.75
4573-060	BELL INDUSTRIES	4A884	DM74ALS573BN	4.20
4674-080	HAMILTON/AVNET ELECTRON	0M8P2	74F674N	75.25
0373-020	CXR SA	44278	N80C186 (PLCC)	56.00
0376-050	ANTHEM ELECTRONICS	1H811	Z85C3008VSC	60.69
0416-010	ANTHEM ELECTRONICS	1H811	SN75451BP	1.76
0437-010	ITT MULTICOMPONENTS	0KDB5	KM62256ALP-120	27.30
0520-010	BELL INDUSTRIES	4A884	LDA100 (PLASTIC)	12.95
0552-010	CYBERNETIC	7Y725	CY325	125.00
0554-010	ITT MULTICOMPONENTS	0KDB5	DS1286	95.90
0555-010	HAMILTON/AVNET ELECTRON	0M8P2	82C59A-2	22.40
0556-020	ITT MULTICOMPONENTS	0KDB5	MS7201A-50NC	30.31
0572-010	ITT MULTICOMPONENTS	0KDB5	MK48Z30B-12	108.25
0647-010	ITT MULTICOMPONENTS	0KDB5	AS7C256-25PC	42.70
0656-010	HAMILTON/AVNET ELECTRON	0M8P2	DSP 56001 FC 20	145.00
03382-310	T.T.I.	0GAS7	3.3 OHMS,5%, (RC32)	
11035-010	T.T.I.	0GAS7	110K OHMS,1%,RN55D	
20015-010	T.T.I.	0GAS7	2000 OHMS,1%,RN55D	
20025-010	T.T.I.	0GAS7	20K OHMS,1%,RN55D	
30115-010	BELL INDUSTRIES	4A884	3010 OHMS,1%,RN55D	
35705-010	BELL INDUSTRIES	4A884	357 OHMS,1%,RN55D	
40215-010	BELL INDUSTRIES	4A884	4020 OHMS,1%,RN55D	
49915-010	BELL INDUSTRIES	4A884	4990 OHMS,1%,RN55D	
61915-010	BELL INDUSTRIES	4A884	6190 OHMS,1%,RN55D	
00125-110	BELL INDUSTRIES	4A884	LC01-1002G	0.80
00024-010	BELL INDUSTRIES	4A884	B37902E0225M050	5.60
01024-310	BELL INDUSTRIES	4A884	302EM200RC102K	0.67
01044-110	BELL INDUSTRIES	4A884	C322C104K5R5CA	0.38
02204-310	BELL INDUSTRIES	4A884	302E0200RC220K	0.67
03304-310	T.T.I.	0GAS7	C052C330K2X5CA	0.80
00013-090	UNITED CHEMI-CON	1W344	SM25VB101M8X11LL	0.56
00054-010	ILLINOIS CAPACITOR	74840	108RSS035M	3.52
01054-610	MARSHALL INDUSTRIES	1K492	ECSFIVE105K	0.80
01063-410	BELL INDUSTRIES	4A884	DSTL 10-20BM	1.44

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 23-55200-020 PC ASSY, ANALOG BD, 5200

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
30-00244-070	ECLIPTEK CORPORATION	0GU66	SA1641-100K	7.04
30-00257-020	WEST COAST MAGNETICS INC	12042	WCM 5600-0005-02	118.16
30-00260-020	LASELCO	15253	2201684(REV.F)	114.10
30-00287-010	SIERRA WEST ELECTRONICS	0NDV6	T2220	50.40
30-00295-040	SARONIX(NYMPH)	61441	NCH069C-12.8000	42.00
30-00298-010	ECLIPTEK CORPORATION	0GU66	NCH-039-C-2.048MHZ	42.00
32-00066-010	BELL INDUSTRIES	4A884	LCA110	13.30
32-00076-010	BELL INDUSTRIES	4A884	TQ2E-5V	12.32
32-00079-010	BELL INDUSTRIES	4A884	TQ2E-L2-5V	21.00
34-00216-010	HAMILTON/AVNET ELECTRON	0M8P2	W3114T	0.56
34-00216-040	HAMILTON/AVNET ELECTRON	0M8P2	W3120T	0.72
34-00216-050	HAMILTON/AVNET ELECTRON	0M8P2	W3108T	0.32
34-00223-020	MARSHALL INDUSTRIES	1K492	W3124T	0.96
34-00223-030	HAMILTON/AVNET ELECTRON	0M8P2	W3128T	1.12
34-00378-020	HAMILTON/AVNET ELECTRON	0M8P2	ICO-243-S8-T	0.96
34-00457-010	ABACUS ELECTRONICS	9M697	TSW-101-07-T-S	0.24
34-00457-030	DC ELECTRONICS SUPPLY	0HF75	WTS-02S-1-T	0.96
34-00567-010	KENT ELECTRONICS	0EUK0	3764-5202	27.09
37-00003-010	SQUIRES ELECTRONICS INC	60386	J0.400X0.125T22	
37-00003-030	SQUIRES ELECTRONICS	60386	J0.200X0.125T22	
37-00003-060	SQUIRES ELECTRONICS INC	60386	J-0.500 X 0.125-T-22	
43-55200-020	CXR	42161		170.00
46-00146-010	ALATEC	79756	2226B	3.68
53-00146-010	CONTROL DESIGN SUPPLY INC	76188	TP-102-01	0.28
60-04003-010	BELL INDUSTRIES	4A884	1N4003	0.24
60-04148-010	HAMILTON/AVNET ELECTRON	0M8P2	1N4148	0.10
64-00113-010	BELL INDUSTRIES	4A884	VM48	2.36
65-00036-020	ARROW ELECTRONICS	0NKP6	LM317HVH(PREF.)	25.90
65-00042-010	BELL INDUSTRIES	4A884	AD536AKQ	106.75
65-00044-010	FUTURE ELECTRONICS	0B699	TL082CN	1.44
65-00094-010	ARROW ELECTRONICS	0NKP6	LT1010CH	23.45
65-00103-010	BELL INDUSTRIES	4A884	OP-249GP	9.45
65-00113-010	BURR-BROWN	4T155	PCM58P	133.42
65-00133-010	BELL INDUSTRIES	4A884	AD746JN	29.75
65-00393-010	BELL INDUSTRIES	4A884	LM393P	1.60
65-07805-910	BELL INDUSTRIES	4A884	UA7805KC	1.68
66-74157-040	HAMILTON/AVNET ELECTRON	0M8P2	MC74HC157N	2.00
66-74245-040	HAMILTON/AVNET ELECTRON	0M8P2	CD74HC245E	2.20
66-74294-040	ARROW ELECTRONICS	0NKP6	M74HC294B1	3.84
66-74573-050	BELL INDUSTRIES	4A884	74HCT573N	2.80
66-74574-040	HAMILTON/AVNET ELECTRON	0M8P2	SN74HC574N	2.48
66-74595-040	HAMILTON/AVNET ELECTRON	0M8P2	SN74HC595N	6.00
67-07406-010	ANTHEM ELECTRONICS	1H811	N7406N	1.60
67-74125-050	ANTHEM ELECTRONICS	1H811	N74LS125AN	1.40
69-00454-010	BELL INDUSTRIES	4A884	MP7503KN	33.25
69-00455-010	BELL INDUSTRIES	4A884	MP7512DIKN	30.10
69-00459-070	ATMEL	1FN41	AT28C16-15PC	44.10
69-00480-010	BELL INDUSTRIES	4A884	PM7524HP	15.68
69-00482-020	BELL INDUSTRIES	4A884	PM7541AGP	69.65

XR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

SSEMBLY: 23-55200-020 PC ASSY, ANALOG BD, 5200

XR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
9-00524-020	ARROW ELECTRONICS	0NKP6	UCN-5801A	10.01
9-00562-010	HAMILTON/AVNET ELECTRON	0M8P2	DSP56ADC16S	175.00
0-01212-310	BELL INDUSTRIES	4A884	120 OHMS, 5%, (RC32)	
0-05182-110	BELL INDUSTRIES	4A884	5.1 OHMS, 5%, 1/4W, CF	
2-10005-010	BELL INDUSTRIES	4A884	100 OHMS, 1%, RN55D	
2-10015-010	BELL INDUSTRIES	4A884	1K OHMS, 1%, RN55D	
2-10025-010	BELL INDUSTRIES	4A884	10K OHMS, 1%, RN55D	
2-10035-010	ERIC ELECTRONICS	2V302	100K OHMS, 1%, RN55D	
2-12105-010	T.T.I.	0GAS7	121 OHMS, 1%, RN55D	
2-12115-010	T.T.I.	0GAS7	1210 OHMS, 1%, RN55D	
2-13725-010	T.T.I.	0GAS7	13.7K OHMS, 1%, RN55D	
2-14325-010	ERIC ELECTRONICS	2V302	14.3K OHMS, 1%, RN55D	
2-15005-010	BELL INDUSTRIES	4A884	150 OHMS, 1%, RN55D	
2-19115-010	BELL INDUSTRIES	4A884	1910 OHMS, 1%, RN55D	
2-20005-010	BELL INDUSTRIES	4A884	200 OHMS, 1%, RN55D	
2-20035-010	BELL INDUSTRIES	4A884	200K OHMS, 1%, RN55D	
2-22115-010	BELL INDUSTRIES	4A884	2210 OHMS, 1%, RN55D	
2-23225-010	BELL INDUSTRIES	4A884	23.2K OHMS, 1%, RN55D	
2-24325-010	BELL INDUSTRIES	4A884	24.3K OHMS, 1%, RN55D	
2-24925-010	BELL INDUSTRIES	4A884	24.9K OHMS, 1%, RN55D	
2-26115-010	BELL INDUSTRIES	4A884	2610 OHMS, 1%, RN55D	
2-26705-010	BELL INDUSTRIES	4A884	267 OHMS, 1%, RN55D	
2-28715-010	BELL INDUSTRIES	4A884	2870 OHMS, 1%, RN55D	
2-30115-010	BELL INDUSTRIES	4A884	3010 OHMS, 1%, RN55D	
2-30125-010	BELL INDUSTRIES	4A884	30.1K OHMS, 1%, RN55D	
2-32415-010	BELL INDUSTRIES	4A884	3240 OHMS, 1%, RN55D	
2-32425-010	BELL INDUSTRIES	4A884	32.4K OHMS, 1%, RN55D	
2-37415-010	BELL INDUSTRIES	4A884	3740 OHMS, 1%, RN55D	
2-38315-010	BELL INDUSTRIES	4A884	3830 OHMS, 1%, RN55D	
2-40215-010	BELL INDUSTRIES	4A884	4020 OHMS, 1%, RN55D	
2-41225-010	BELL INDUSTRIES	4A884	41.2K OHMS, 1%, RN55D	
2-42215-010	T.T.I.	0GAS7	4220 OHMS, 1%, RN55D	
2-45315-010	T.T.I.	0GAS7	4530 OHMS, 1%, RN55D	
2-47515-010	T.T.I.	0GAS7	4750 OHMS, 1%, RN55D	
2-48715-010	T.T.I.	0GAS7	4870 OHMS, 1%, RN55D	
2-49905-010	T.T.I.	0GAS7	499 OHMS, 1%, RN55D	
2-49915-010	BELL INDUSTRIES	4A884	4990 OHMS, 1%, RN55D	
2-51185-010	BELL INDUSTRIES	4A884	51.1 OHMS, 1%, RN55D	
2-60405-010	T.T.I.	0GAS7	604 OHMS, 1%, RN55D	
2-60415-010	BELL INDUSTRIES	4A884	6040 OHMS, 1%, RN55D	
2-71505-010	BELL INDUSTRIES	4A884	715 OHMS, 1%, RN55D	
2-78705-010	BELL INDUSTRIES	4A884	787 OHMS, 1%, RN55D	
2-84505-010	BELL INDUSTRIES	4A884	845 OHMS, 1%, RN55D	
2-88705-010	BELL INDUSTRIES	4A884	887 OHMS, 1%, RN55D	
2-90905-010	BELL INDUSTRIES	4A884	909 OHMS, 1%, RN55D	
2-90915-010	BELL INDUSTRIES	4A884	9090 OHMS, 1%, RN55D	
2-90985-010	ERIC ELECTRONICS	2V302	90.9 OHMS, 1%, RN55D	
9-00125-060	BELL INDUSTRIES	4A884	C10-1-102-G	0.80
9-00125-110	BELL INDUSTRIES	4A884	LC01-1002G	0.80

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 23-55200-020 PC ASSY, ANALOG BD, 5200

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
79-00128-010	PASSIVE TECHNOLOGY	0NYV4	VZA300	1.60
79-00129-070	BELL INDUSTRIES	4A884	64Y-501	5.60
79-00129-080	BELL INDUSTRIES	4A884	64Y-101	5.60
79-00131-020	FUTURE ELECTRONICS	0B699	P5KE406A	4.40
81-00010-030	IMB ELECTRONICS	27556	C11C2154J	13.15
82-00001-020	AVX	04222	MD015A101JAB	1.68
82-00001-060	AVX	04222	MD015A221JAB	1.68
82-00001-080	AVX	04222	MD015A331JAB	1.68
82-00001-100	AVX	04222	MD015A471JAB	1.80
82-00001-140	AVX	04222	MD015A102JAB	3.04
82-00001-160	AVX	04222	MD015A152JAB	2.00
82-00001-180	AVX	04222	MD015A222JAB	2.00
82-00001-200	CXR	42161		2.80
82-00001-250	AVX	04222	MD025A103JAB	5.60
82-00024-010	BELL INDUSTRIES	4A884	B37902E0225M050	5.60
82-00024-020	BELL INDUSTRIES	4A884	VP23BY105M	1.44
82-00028-080	HAMILTON/AVNET ELECTRON	0M8P2	B37988E0224M050	0.52
82-00029-010	BELL INDUSTRIES	4A884	C410C104M5U5CA	0.30
82-00033-010	BELL INDUSTRIES	4A884	B37981C101K100	0.72
82-00035-010	AVX	04222	SA105A102JAA	0.72
82-00039-040	CENTREX ELECTRONICS	4Y091	C315C471J1G5CA	1.68
82-02214-310	BELL INDUSTRIES	4A884	C052C221K2X5CA	0.80
83-00001-020	BELL INDUSTRIES	4A884	CD15CD030D03	0.96
86-00039-010	ILLINOIS_CAP	74840	107RMR100A	2.88
87-01064-410	HAMILTON/AVNET ELECTRON	0M8P2	199D106X9020CA2	1.28
87-01074-410	HAMILTON/AVNET ELECTRON	0M8P2	TAP107K020HSB	8.89
87-02264-610	HAMILTON/AVNET ELECTRON	0M8P2	NDL226K35K	6.00
87-03353-610	BELL INDUSTRIES	4A884	DSTL 3.3-35BM	1.76

R COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

SEMBLY: 23-55200-021 TSTD PC ASSY, ANALOG BD, 5200

R PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
-55200-131	CXR	42161		52.01
-55200-140	CXR	42161		69.84
-55200-150	CXR	42161		94.37

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 25-55200-010 CABLE.ANALOG/MAIN BD.,I/F,5200

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
34-00568-010	AMP	18342	1-746285-2	18.13
37-00159-800	3M	OESF3	3539/64	

XR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

SSEMBLY: 25-55200-020 CABLE,XMT/RCV TEL JACK,5200

XR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
4-00072-010	MOLEX	27264	08-50-0106	
4-00077-180	MOLEX	27264	09-50-3181	4.24
4-00437-010	ALATEC	79756	RSK201 BLUE	3.52
4-00448-010	CAL SWITCH	1GT38	M-112B	8.19
7-00141-800	NATIONAL WIRE	04569	NB1936N2SJBLK/WHT	
7-06000-550	ALPHA WIRE	92194	FIT-221-3/16WHT	
2-00252-010	PRO FASTENERS	0RAW5	TY51M	
3-00141-060	PRO FASTENERS	0RAW5	1412-6	0.48

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 25-55200-030 CABLE, CONTRAST/VOLUME, 5200

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
34-00072-010	MOLEX	27264	08-50-0106	
34-00077-080	MOLEX, INC.	27264	09-50-3081	1.92
42-00003-010	PRO FASTENERS	0RAW5	SST1M-CP	
42-00252-010	PRO FASTENERS	0RAW5	TY51M	
79-00160-011	CXR	42161		24.36
79-00178-010	MOUSER ELECTRONICS	2T737	31XP401	7.91

COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

MBLY: 25-55200-040 CABLE,LCD BACKLITE,5200

PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
0072-010	MOLEX	27264	08-50-0106	
0077-020	MOLEX, INC.	27264	09-50-3021	0.48
0437-010	ALATEC	79756	RSK201 BLUE	3.52
0472-080	BELL INDUSTRIES	4A884	65039-034	4.16
0473-010	BELL INDUSTRIES	4A884	47745-000	
0141-800	NATIONAL WIRE	04569	BN-24-1936(2)SJV90/9	
0252-010	PRO FASTENERS	0RAW5	TY51M	

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 25-55200-050 CABLE,LCD DISPLAY,5200

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
34-00442-060	SPECTRA STRIP/AMPHENOL	18342	812-2022-134	12.32
37-00053-800	3M	0ESF3	3365/20	
42-00292-010	3M	0ESF3	3435-0	

XR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

SSEMBLY: 25-55200-060 CABLE, SPEAKER, 5200

XR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
4-00072-010	MOLEX	27264	08-50-0106	
4-00077-020	MOLEX, INC.	27264	09-50-3021	0.48
5-00031-010	MG ELECTRONICS	40370	TS50S-8 OHMS	7.60
7-00021-100	STORM PRODUCTS	6E665	154 TO SPEC	
2-00252-010	PRO FASTENERS	0RAW5	TY51M	

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 25-55200-090 WIRE HARNESS,SPRING, 5200

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
54-00123-010	CXR	42161		6.16

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 25-55200-140 CABLE, GROUNDING, 5200-02

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
53-00052-080	PRO FASTENERS	0RAW5	RA853	

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 25-55200-170 CABLE,FAN,5200-02

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
31-00076-010	RICHEY-CYPRESS ELECTRONICS	0LJ92	M33401-16	76.16
34-00072-010	MOLEX	27264	08-50-0106	
34-00077-020	MOLEX, INC.	27264	09-50-3021	0.48
42-00003-010	PRO FASTENERS	0RAW5	SST1M-CP	
42-00252-010	PRO FASTENERS	0RAW5	TY51M	

XR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

SSEMBLY: 26-55200-011 FRONT PANEL ASSY,5200-02

XR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
5-55200-020	CXR	0GPT9		121.10
5-55200-030	CXR	42161		55.09
5-55200-040	CXR	42161		32.90
5-55200-050	CXR	2V302		21.35
7-50034-290	CXR	42161		48.79
4-00085-120	BELL INDUSTRIES	4A884	65508-103	1.16
4-00220-020	DC ELECTRONICS SUPPLY	0HF75	65610-220	6.00
4-50801-310	CXR	42161		6.66
4-55200-011	CXR	42161		216.75
4-55200-080	CXR	0KUN1		6.48
5-55200-010	CXR	07416		382.15
3-00142-010	ALATEC	79756	BP21R	14.00
3-00142-030	ALATEC	79756	BP21GN	14.00
3-00142-050	ALATEC	79756	BP21B	13.65
4-00076-010	SCHROFF	0L8B6	10603-025	8.96
4-00133-010	ELMA ELECTRONICS	76096	020-3225	7.84
4-00133-020	ELMA ELECTRONICS	76096	020-3525	7.84
4-00134-010	ELMA ELECTRONICS	76096	040-3025	0.96
4-00135-010	ELMA ELECTRONICS	76096	044-3025	1.84
4-00136-010	TOSHIBA	0DV96	TLX1013-E0	350.00

CXR COMPONENT MANUFACTURERS CROSS-REFERENCE LISTING

ASSEMBLY: 26-55200-021 REAR PNL ASSY,5200-02(W/BATT)

CXR PART NO.	VENDOR/MFG'S NAME	CAGE CODE	MANF'S PART NR	PRICE
25-55200-060	CXR	42161		45.99
34-00072-010	MOLEX	27264	08-50-0106	
34-00077-020	MOLEX, INC.	27264	09-50-3021	0.48
34-00453-020	CXR	42161	PER SPEC.	
42-00248-010	PRO FASTENERS	0RAW5	2183	1.36
44-00017-010	BELL INDUSTRIES	4A884	572621	12.25
44-55200-041	CXR	42161		98.70
44-55200-110	CXR	42161		70.84
44-55200-120	CXR	42161		65.59
44-55200-170	CXR	42161		36.40
53-00190-010	PRO FASTENERS	0RAW5	2376-832A35	7.20
54-00132-010	CXR	42161		4.08

REPLACEABLE PARTS

INTRODUCTION

This section contains information for ordering and replacing parts for the Model 5200-17. The next pages list all the parts for each section of the instrument and provide the information for each item:

a. CXR Part Number
b. Parent Part Number
c. Total Part Quantity Per Level
d. Descriptions

ORDERING REPLACMENT PARTS

To order a replacment part from the CXR Telcom Company, address the order or inquiry to the nearest CXR Telcom Sales/Service Office (list in the warranty section) and supply the following:

a. Model Number of the Instrument
b. Parent Part Number
c. CXR Part Number of Item(s)

It is important to note that certain 5200-17 integrated circuit components namely "EPROM" and "PAL" devices are custom programmed components and are not listed in Section A. Such devices must be ordered directly from CXR Telcom.

PARENT PART: 18-55200-170
REF PAGE: C-2

5200-17 FINAL ASSY (NAVY)
Rev A1

CXR PART NO.	DESCRIPTION	REF	UM	QTY
21-55200-170	BASIC ASSY 5200-17	A1	EA	1
37-00131-800	CORD-POWER 8' M/F PLUGS	20	EA	1
41-50005-080	CXR TELCOM NAMEPLATE BLK BDGND	MP1	EA	1
41-50020-310	LABEL, SERIAL NO, 5200	MP2	EA	1
44-50800-380	DUST COVER-800 SERIES	A2	EA	1
44-55200-220	BRACKET, 19 IN RACK ADAPTER, 5200	45	EA	2
96-55200-100	OPERATION/MAINTENANCE MANUAL, 5200	902	EA	2

PARENT PART: 21-55200-170
REF PAGE: C-4

BASIC ASSY, 5200-17
Rev B

CXR PART NO.	DESCRIPTION	REF	UM	QTY
23-55200-013	TSTD PC ASSY, MAIN BD, 5200-17	A1	EA	1
23-55200-021	TSTD PC ASSY, ANALOG BD, 5200	A2	EA	1
25-55200-010	CABLE, ANALOG/MAIN BD., I/F, 5200	CA1, 2	EA	2
26-55200-011	FRONT PANEL ASSY, 5200-02	A3	EA	1
26-55200-021	REAR PANEL ASSY, 5200-02 (W/BATTERIES)	A4	EA	1
31-00067-010	BATTERY, RECHARGABLE, 1.2V	BT1	EA	10
33-00282-010	FUSE-CART, 500MA, 250V, SL-BLOW	F1	EA	2
37-00011-010	WIRE SHIELDING, RF, 9 INCH LG.	37	EA	4
42-00268-020	TAPE FOAM SINGLE COLATED 1/4"T	MP19	IN	24
44-50801-310	RUBBER BUMPER	MP18	EA	6
44-55200-031	SIDE, PANEL, RIGHT, 5200-02	MP20	EA	1
44-55200-050	COVER CAP, HANDLE, 5200	MP21	EA	2
44-55200-060	COVER, UNIVERSAL, 5200-02	MP1, 2	EA	2
44-55200-071	BEZEL, REAR, 5200-02	MP22	EA	1
44-55200-100	BATTERY RETAINER	MP9	EA	1
50-00092-020	SCREW, FH, 100, PHIL, SS, 8-32X, 0.50	MP23	EA	2
50-63204-210	SCREW-PH, PHIL, SS, 6-32, 0.250 LG	MP8	EA	10
50-63206-210	SCREW-PH, PHIL, SS, 6-32, 0.375 LG	MP4	EA	10
50-63208-210	SCREW-PH, PHIL, SS, 6-32, 0.500 LG	MP25	EA	16
50-63212-210	SCREW-PH, PHIL, SS, 6-32, 0.750 LG	MP27	EA	1
50-83204-210	SCREW-PH, SS, 8-32 X 3/8	MP10	EA	6
50-92008-210	SCREW-PH, PHIL, 1/4-20 X 1/2 LG, SS	MP15	EA	2
51-63200-310	KEP-NUT, 6-32 X 1/4, SS, STEEL	MP28	EA	2
52-00035-010	WASHER-FLAT, FI, #6, 0.250 OD, 0.063 T	MP29	EA	12
52-00050-020	WASHER-INT, TOOTH, SS, #6, 0.290 0D	MP6	EA	17
52-60031-720	WASHER, FLAT, NY, #6, 0.312 ODX .047 T	MP12	EA	14
52-00050-050	WASHER, INT LOCK, 1/4, SS	MP16	EA	2
53-00052-080	TERM RING INSUL 22-18 AWG	MP14	EA	1
53-00148-260	STANDOFF, 1/4 HEX, F/F, 6-32, 1.00, SS	MP30	EA	2
53-00195-010	SCREW, CON-D, LOCK, 4-40, SS	MP7	EA	4
53-00170-030	STANDOFF, 1/4 HEX, M/F, 6-32, 1.00, SS	MP31	EA	1
53-00170-040	STANDOFF, 1/4HEX, SS, 6-32X.625LG	MP11	EA	4
53-00148-050	STANDOFF, AL, EX, 6-32, 1/4X.625LG	MP17	EA	1
54-00103-010	HANDLE, CARRY, 8.5-IN, BLK VINYL	MP24	EA	1
54-00126-010	PAD, POP RIVET, 0.130 ID, 0.06T, ALUM	MP5	EA	4
54-00127-010	RIVET, POP, 1/8 DIA, CLOSED END	MP13	EA	4
54-00138-010	SHIELDING, GASKET, RF, 13 INCH LG.	172	EA	4
56-00043-010	POUCH, CLOTH ACCS'Y, BLK, 5200	MP3	EA	1

PARENT PART: 25-55200-010
REF PAGE: C-7

CABLE, ANALOG/MAIN BD., I/F, 5200
Rev A

CXR PART NO.	DESCRIPTION	REF	UM	QTY
34-00568-010	CONN., RECEPT., 64 PIN, POLARIZED	1	EA	2
37-00159-800	RIBBON CABLE, 64 COND. 28 AWG	2	IN	4

CXR PART NO.	DESCRIPTION	REF	UM	QTY
23-55200-019	PC ASSY, MAIN BD, 5200	5	EA	1
30-00336-010	XFMR, PWR, 120/240 -28V SEC	T1	EA	1
69-55200-050	IC, 750L-25 PAL (KYB)	U14	EA	1
69-55200-060	IC, 750L-25 PAL (LCD)	U36	EA	1
69-55200-071	IC, 750L-25 PAL (SRL)	U43	EA	1
69-55200-081	IC, 730L-30 PAL (FID)	U44	EA	1
69-55200-090	IC, 750L-25 PAL (HST)	U49	EA	1
69-55200-101	IC, 18CV8-15 PAL (DSP)	U55	EA	1
69-55200-111	IC, 173C-30 PAL (LCD)	U15	EA	1
69-55200-120	IC, 750L-25 PAL (I/O)	U75	EA	1
28-55200-190 (See Note 1)	IC, 27C010-12 EPROM (HIGH/LOW/ODD/EVEN)	U6, U7, U10, U11	EA	1

Note 1: CXR Part #28-552200-190 includes the required four (4) EPROM kit U6, U7, U10 and U11, since these EPROMs must always be replaced as a quantity four (4) IC kit.

PARENT PART: 23-55200-019 **PC ASSY, MAIN BOARD, 5200-17**
REF PAGE: C-9 **Rev A**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
30-00233-030	XTAL, HC18, PAR, 100PPM, 12.00 MHZ	Y3	EA	1
30-00233-040	XTAL, HC18, PAR, 100PPM, 20.00 MHZ	Y1	EA	1
30-00295-010	XTAL, OSC, HCMOS, .01, 4.9152 MHZ	Y2	EA	1
30-00295-030	XTAL, OSC, HCMOS, .01, 20.4800 MHZ	Y5	EA	1
30-00335-010	XTAL, OSC, HCMOS, .01, 4.608 MHZ	Y6	EA	1
30-00336-010	XFMR. PWR.120/240-28V SEC	T1	EA	1
30-00335-020	XTAL, OSC, HCMOS, .01, 13.0 MHZ	Y4	EA	1
33-00256-010	MICROFUSE HOLDER	XF1,2	EA	2
33-00257-030	MICROFUSE, LAMP	F1,2	EA	2
34-00076-180	CONN, HDR, .156SP, LOCK, 18 PIN	J12	EA	1
34-00085-140	CONN HEADER STRAIGHT 2 PIN	JP1,4,5	EA	3
34-00195-020	UMPER, MINI, 2 POS., FEM.	53	EA	1
34-00220-020	CONN, 20PIN PC MTG	J6	EA	1
34-00235-020	CONN, HDR, 2PIN, .156SP, LOCKING	J4,8,13.15.16	EA	5
34-00235-050	CONN, HDR, 5PIN, .156 LOCKING TIN	J1	EA	1
34-00235-080	CONN WAFER 8-PIN	J11	EA	1
34-00661 -010	CONNECTOR RIGHT ANGLE	J2,3	EA	2
34-00378-020	SOCKET, IC 24PIN, .3X.1 CTRS	XU14,15,36 43,44,49,55,75	EA	8
34-00378-030	SOCKET, IC 28PIN, .3SP (.160HT)	XU48,52,54,56 61 68-70,76,77,79-84	EA	20
34-00390-010	SOCKET, IC, 68 PIN, PLCC	XU5	EA	1
34-00662-010	CONN D-SUB RA 25 SOC	J5	EA	1
34-00457-100	CONN-15 PIN SNGL ROW HDR	J7	EA	1
34-00464-070	SOCKET, IC, .6 SP, 28 POS	XU22,23,30	EA	3
34-00464-080	IC, SOCKET SCREW, MACHINE, 32 PIN	XU6,7,10,11	EA	4
34-00464-100	SOCKET, IC, .6 SP, 40 POS	XU31	EA	1
34-00496-010	SOCKET, IC 44 PIN, PLCC	XU2	EA	1
34-00540-020	CON, MOD JCK, RA, 6/4 POS, RJ11	J14	EA	1
34-00653-010	SOCKET, IC, SLAM PACK, 132 PIN	XU47,51	EA	2
34-00567-010	CONN, HDR, DR, RA, 64 PIN, SPEC	J9,10	EA	2
34-00653-020	SOCKET, COVER	XU47,51	EA	2
39-00055-030	CONVERTER. 5 VDC/120 VAC, 240 MA	PS2	EA	1
39-00062-010	CONVERTER, DC-DC, +12, +5V, 15W	PS1	EA	1
42-00048-010	BEAD, GLASS, .0321D, .062HT	152	EA	3
43-55200-011	PC BOARD, MAIN BD, 5200	PCB1	EA	1
44-50003-250	INSULATOR MOTHER BRD 803		EA	1
44-55200-240	SUPPORT BRACKET, TRANSFORMER, 5200	162	EA	2
44-55200-250	INSULATOR , XFMR SUPPORT 5200	163	EA	2
46-00139-010	HEATSINK SNAP ON TO-51 TO -39	165	EA	1

CXR PART NO.	DESCRIPTION	REF	UM	QTY
50-44006-210	SCREW-PH, PHIL, SS, 4-40 x .375 LG	166	EA	6
50-63205-210	SCREW-PH PHIL, SS, 6-32 Xx .312 LG	167	EA	2
50-63218-210	SCREW-PH PHIL, SS, 6-32x1 1/8LG	169	EA	4
51-44000-310	KEPNUT, 4-40, SS	170	EA	6
52-00016-900	WASHER NO.6 FLAT NYLON	171	EA	2
52-00051-020	WASHER SPLIT, SS, NO.6	175	EA	4
52-60000-310	WASHER FLAT NO.6, SS	173	EA	4
53-00052-080	TERM RING, INSUL, 22-18 AWG	178	EA	1
53-00146-010	WIRE LOOP TEST POINT-PC MNT	TP1 -7	EA	7
60-05400-010	DIODE, 1N5400, 50V, 3A	CR2	EA	1
60-05818-010	DIODE, 1N5818, 1A, 30V, SCHOTTKY	CR4-10,13-15	EA	10
61-00825-110	DIODE, ZENER, 1 N825A, 6.2V REF	CR11	EA	1
61-05822-010	DIODE, 1N5822, SCHOTTKY, 40V, 3A	CR3	EA	1
63-03906-010	XSTR, 2N3906, PNP (TO-92)	Q1	EA	1
64-00102-010	ARRESTOR	RV1 -5	EA	5
64-00120-030	DIODE, BRIDGE, 200V, 6A	CRI	EA	1
65-0036-020	IC, LM317 ADJ VOLTAGE REG TO -39	U27	EA	1
65-00046-010	IC, 7705, 5V VOLTAGE SUPERVISOR	U62	EA	1
65-00111 -010	IC, 34119 LOW PWR AUDIO AMP	U63,64	EA	2
65-00112-010	IC, 1141 RS232DRIVER/RECEIVER	U3,4	EA	2
65-00393-010	IC, LM393 VOLTAGE COMP	U65	EA	1
66-07404-090	IC, 74AC04 HEX INVERTER	U25,37	EA	2
66-74126-070	IC, 74BCT126 QUAD BUS BUFFER	U38	EA	1
66-74151-050	IC, 74HCT151, SCHNL MULTIPLEXER	U41,46	EA	2
66-74245-080	IC, 74ACT245 8-BIT TRANSCEIVER	U12,13,34,40	EA	4
66-74259-050	IC, 74HCT259	U21,24	EA	2
66-74377-050	IC, 74HCT377, 8-FLIP/FLOPS	U67,72	EA	2
66-74573-080	IC, 74ACT573 OCTAL LATCH	U1,8,9,18,20, 33 39 45	EA	8
66-74595-040	IC, 74HC595 SHIFT REF W/LTCHS	U73,74	EA	2
66-74841-080	IC, 74ACT841, 10-BIT LATCH	U35	EA	1
66-74922-030	IC, 74C922 16-KEY ENCODER	U19,26	EA	2
67-74573-060	IC, 74ALS5730CTAL D-LATCH	U28	EA	1

CXR PART NO.	DESCRIPTION	REF	UM	QTY
67-74674-080	IC, 74F674 16-BIT SHIFT REG	U71	EA	1
69-00373-020	IC, 80C186, 16-BIT, MPV 10 MHZ, PLC	U5	EA	1
69-00376-050	IC, 85C30 2-CH SCC, 8 MHZ PLCC	U2	EA	1
69-00416-010	IC 75451 DUAL PERIPHERAL DRIVER	U42	EA	1
69-00437-010	IC, 55257, 32KX8 SRAM, 120 NS	U22, 23	EA	2
69-00520-010	IC, LDA100, Bi-DIR OP TO COUPLER	U66,78	EA	2
69-00552-010	IC, CY325 LED WINDOW CONTROLLER	U31	EA	1
69-00554-010	IC, DS1286 WATCHDOG TIMEKEEPER	U29	EA	1
69-00555-010	IC, 82C59A-2 PRGM INT CONTR	U30	EA	1
69-00556-020	IC, 75C01A-65 FIFO F12X9 65 NS	U69,70	EA	2
69-00656-010	IC, 56001, DSP, 20 MHZ QFP	U47,51	EA	2
69-00572-010	IC, 1230AB-120 SRAM 256K 120 NS	U16,17	EA	2
69-00647-010	SRAM, 32KX8, 25 NS	U48,52,54,59-61	EA	6
70-03382-310	RES, CC, 3.3 OHM, 05, 1W	R1	EA	1
72-11035-010	RES MF 110K 01 1/8W	R4	EA	1
72-20015-010	RES MF 2K OS 1 /8W	R8,10	EA	1
72-20025-010	RES MF 20K 01 1/8W	R2	EA	1
72-30115-010	RES MF 3.01K, 01, 1/8W	R3	EA	1
72-35705-010	RES MF 357 OW 1/8W	R5,7	EA	2
72-40215-010	RES MF 4020 01 1/8W	R18	EA	1
72-49915-010	RES MF 4990 01 1/8W	R6	EA	1
72-61915-010	RES MF 6190 01 1/8W	R20	EA	1
79-00125-110	RES-PAK, 10 PIN, 9 RES, 10K, 2	RP1-22	EA	22
82-00024-010	CAP, CER, 2.2UF, 20, 50V, .2SP	C114	EA	1
82-01024-310	CAP, CER, .001UF, 10, 200V	C67,73,94, 109,110	EA	5
82-01044-110	CAP, CER, .1UF, 10, 50V	C4,5,8,10-17, 20-27,30,31,33-39, 41,42,44-50,56-64 66,68-71,74,76-78, 80,82,84-93,96-98, 100-105,107,108, 111-113,115-119	EA	86
82-02204-310	CAP, CER, SSPF, 10, 200V	C1	EA	1
82-03304-310	CAP, CER 33PF, 10, 200V	C2,52,53	EA	3
86-00013-090	CAP, ELE, 100UF, 20, 25V	C43,65,79,81	EA	4
86-00054-010	CAP, ELE, 1000UF, 20, 35V, RADL, LP	C18	EA	1
87-01054-610	CAP, TAN, 1.0UF, 10, 35V	C32,40,95,99	EA	4

PARENT PART: 23-55200-021
REF PAGE: C-19

TESTED PC ASSY, MAIN BOARD, 5200-17
Rev B

CXR PART NO.	DESCRIPTION	REF	UM	QTY
23-55200-020	PC ASSY, ANALOG BD, 5200	5	EA	1
69-55200-131	IC, 22V10-25 PAL (PAL 9)	U30	EA	1
69-55200-140	IC, 22V10-25 PAL (PAL 10)	U34	EA	1
69-55200-150	IC, 20RA10-30PAL (PAL11)	U46	EA	1

PARENT PART: 23-55200-020
REF PAGE: C-20

PC ASSY, ANALOG BOARD, 5200-17
Rev A8

CXR PART NO.	DESCRIPTION	REF	UM	QTY
30-00244-070	COIL, RF, 100UH, 10, SHIELDED	L1,2	EA	2
30-00257-020	XMFR, HIGH FREQUENCY, 110 KHZ	T2	EA	1
30-00260-020	XMFR, HIGH FREQUENCY, 110 KHZ	T1	EA	1
30-00287-010	XMFR, COUPLING, 600/600 OHMS	T3,4	EA	2
30-00295-040	XTAL OSC, HCMOS, 12.8 MHZ, .01	Y1	EA	1
30-00298-010	XTAL OSC, HCMOS, 2.048 MHZ, .01	Y2	EA	1
32-00066-010	RELAY, 6-DIP DC/AC LCA110	U8,15,16	EA	3
32-00076-010	RELAY, TQ, DPDT, 5V	K11 -14	EA	4
32-00079-010	RELAY, DPDT, 2-COIL LATCH, 5V	K2-10	EA	9
34-00216-010	IC SOCKET 14 PIN	XU4	EA	1
34-00216-040	IC SOCKET 20 PIN	XU18	EA	1
34-00216-050	IC SOCKET 8 PIN	XU 13	EA	1
34-00223-020	IC SOCKET 24 PIN	XU47	EA	1
34-00223-030	IC SOCKET 28PIN	XU19	EA	1
34-00378-020	IC SOCKET, 24 PIN, .3X.1 CTRS	XU30,34,46	EA	3
34-00457-010	CONN, HDR 1 PIN ST, .1 STACKABLE	TP1-17	EA	17
34-00457-030	CONN, HDR 2 PIN, .100 SP, .230	E2,3	EA	2
34-00567-010	CONN, HDR, DR, RA, 64 PIN, SPEC	J1,2	EA	2
37-00003-010	WIRE, JUMPER FORMED, 0.400 LG	76	EA	8
37-00003-030	JUMPER WIRE FORMED, 0.200 LG	REF C12, 125	EA	2
37-00003-060	JUMPER WIRE FORMED, 0.500 LG	REF 11,12	EA	2
43-55200-020	PC BOARD, ANALOG BD, 5200	PCB1	EA	1
46-00146-010	HEAT SINK, 0, .75 DIA, T0-5	HS1,2	EA	2
60-04003-010	DIODE IN4003	CR1-4	EA	4
60-04148-010	DIODE IN4148	CR6-12,17-20,25-27	EA	14
64-00113-010	DIODE, BRIDGE, 1A, 400V, 4 PIN, DIP	BR1,2	EA	2
65-00036-020	IC, LM317, ADJ VOLTAGE REG, TO-39	VR1,2	EA	2
65-00042-010	IC, AD536AK, RMS/DC CONV TO-116	U5	EA	1
65-00044-010	IC, TL082 DUAL JFET, OP, AMP	U40	EA	1
65-00094-010	IC, 1010 OP, AMP, PWR BUFFER	U9	EA	1
65-00103-010	IC, AD712, BIFET, OP, AMP	U2,10,11,13,42-45,49-52	EA	12
65-00113-010	IC, PCM58, D/A CONVERTER	U19	EA	1
65-00133-010	IC, AD746J DUAL OP AMP	U12.17	EA	2
65-00393-010	IC, LM393, VOLTAGE COMP	U6,7	EA	2
65-07805-910	VOLT REG POS 5V	VR3	EA	1
66-74157-040	IC, 74HC157, QUAD, 2-IN MUX	U22	EA	1
66-74245-040	IC, 74HC245, OCTAL TRANSCEIVER	U32,33	EA	2
66-74294-040	IC, 74HC294, PRGMBL FREQ DIVIDER	U31	EA	1

CXR PART NO.	DESCRIPTION	REF	UM	QTY
66-74573-050	IC, 74HCT573, OCTAL, D LTCH, 3-STE	U38	EA	1
66-74574-040	IC, 74HC574, OCTAL, 3-STATE, D-TPE	U20,25,26,37,39,41	EA	6
66-74595-040	IC, 74HC595, SHIFT REG W/LTCHS	U28,29	EA	2
67-07406-010	IC, 7406	U14	EA	1
67-74125-050	IC, 74LS125	U21	EA	1
69-00454-010	IC, 7503, 8-CHNL, ANALOG MUS	U1,3,23	EA	13
69-00455-010	IC, 7512, DUAL SPDT, ANALOG SWTCH	U4,48	EA	2
69-00459-070	IC, 28C16-15 EEPROM, 2KXB, 150 NS	U47	EA	1
69-00480-010	IC, 7524 8-BIT BUFF, MULT, D-A CON	U27	EA	1
69-00482-020	IC, 7541A, 12-BITD-ACONV	U24	EA	1
69-00524-020	IC, 5801 BIMOS DRVR 8 LATCHES	U35,36	EA	2
69-00562-010	IC, DSP56ADC16, A-D CONVERTER	U18	EA	1
70-01212-310	RES, CC, 120, 05, 1W	R45,46	EA	2
70-05182-110	RES, CC, 5.1, 5, 1/4W	R36	EA	1
72-10005-010	RES, MF, 100, 01, 1/8W	R49,73	EA	2
72-10015-010	RES, MF, 1K, 01, 1/8W	R4,10,14,15,17,19,38,	EA	11
		41,42,59,84		
72-10025-010	RES, MF, 10K, 01, 1/8W	R30,43,50,51,53-56	EA	10
72-10035-010	RES, MF, 100K 01, 1/8W	R22,23,85	EA	3
72-12105-010	RES, MF, 121, 1, 1/8W	R5	EA	1
72-12115-010	RES, MF, 1210, 01, 1 /8W	R34	EA	1
72-13725-010	RES, MF, 13.7K, 01, 1/8W	R64	EA	1
72-14325-010	RES, MF, 14 3K, 01, 1/8W	R76	EA	1
72-15005-010	RES, 150, 1, 1/8W	R33	EA	1
72-19115-010	RES, MF, 1910 01, 1 /8W	R77 80	EA	2
72-20005-010	RES, MF, 200, 1, 1/8W	R35 69	EA	2
72-20035-010	RES, MF, 200K 01, 1/8W	R2,3	EA	2
72-22115-010	RES, MF, 2210, 01, 1/8W	R57,58	EA	2
72-23225-010	RES, MF, 23.2K, 01, 1/8W	R86	EA	1
72-24325-010	RES MF, 24.3K 01, 1/8W	R29	EA	1
72-24925-010	RES MF, 24.9K 01, 1/8W	R66	EA	1
72-26115-010	RES, MF, 2610, 01, 1/8W	R31	EA	1
72-26705-010	RES, MF, 267, 1, 1/8W	R37	EA	1
72-28715-010	RES, MF, 2870, 01, 1/8W	R47 48	EA	2
72-30115-010	RES, MF, 3.01K, 01, 1/8W	R20 60	EA	2
72-30125-010	RES, MF, 30.1 K, 1, 1 /8W	R67	EA	1
72-32415-010	RES, MF, 3 24K, 1, 1/8W	R81,83	EA	2
72-32425-010	RES, MF, 32.4K, 1, 1/8W	R61	EA	1
72-37415-010	RES, MF, 3740, 01, 1/8W	R78	EA	1
72-38315-010	RES, MF, 3.83K, 1, 1/8W	R63	EA	1
72-40215-010	RES, MF, 4020, 01, 1/8W	R16,18,39,40	EA	4
72-41225-010	RES, MF, 41.2K, 01, 1/8W	R87	EA	1
72-42215-010	RES, MF, 4.22K, 1, 1/8W	R82	EA	1
72-45315-010	RES, MF, 4530, 01, 1/8W	R68	EA	1
72-47515-010	RES, MF, 4750, 01, 1/8W	R28	EA	1

CXR PART NO.	DESCRIPTION	REF	UM	QTY
72-48715-010	RES, MF, 4870, 01, 1/8W	R65	EA	1
72-49905-010	RES, MF, 499, 1, 1/8W	R27	EA	1
72-49915-010	RES, MF, 4990, 01, 1/8W	R24-26	EA	3
72-51185-010	RES, MF, 51, 1, 1, 1/8W	R13,44	EA	2
72-60405-010	RES, MF, 604, 01, 1/8W	R1	EA	1
72-60415-010	RES, MF, 6.04K, 1, 1/8W	R62	EA	1
72-71505-010	RES, MF, 715, 01, 1/8W	R79	EA	1
72-78705-010	RES, MF, 787, 1, 1/8W	R8,9	EA	2
72-84505-010	RES, MF, 845, 1, 1/8W	R7	EA	1
72-88705-010	RES, MF, 887, 1%, 1/8W	R75	EA	1
72-90905-010	RES, MF, 909, 01, 1/8W	R32,71	EA	2
72-90915-010	RES, MF, 9090, 01, 1/8W	R70	EA	1
72-90985-010	RES, MF, 90. 9, 1, 1/8W	R74	EA	1
79-00125-060	RES PAK , 10 PIN, 9 RES, 1.0K, 2	RP2	EA	1
79-00125-110	RES PAK, 10 PIN, 9 RES, 10K, 2	RP1	EA	1
79-00128-010	VARISTOR-300V AC RMS, 0.34 IN DIA	RV1,2	EA	2
79-00129-070	RES-VAR MULTITRN 500, 10, 1/2W	R52,72	EA	2
79-00129-080	RES-VAR MULTITRN 100, 10, 1/2W	R6	EA	1
79-00131-020	VOLTAGE SUPPRESSOR-500W, 44-49V	CR5,28	EA	2
81-00010-030	CAP, MET, POLY, AX, 2.15UF, 5, 200V	C7	EA	1
82-00001-020	CAP, CER, RDL, 100 PF, 05, 50V	C83,84,86,87,116	EA	5
82-00001-060	CAP, CER, RDL, 220 PF, 05, 50V	C81,85,108	EA	3
82-00001-080	CAP, CER, RDL, 330 PF, 05, 50V	C117	EA	1
82-00001-100	CAP, CER, RDL, 470 PF, 05, 50V	C105	EA	1
82-00001-140	CAP, CER, RDL, 1000 PF, 05 50V	C69,78,80	EA	3
82-00001-160	CAP, CER, RDL, 1500 PF, 05, 50V	C82	EA	1
82-00001-180	CAP, CER , RDL 2200 PF, 05 50V	C102	EA	1
82-00001-200	CAP, CER, RDL 3300 PF, 05 50V	C115	EA	1
82-00001-250	CAP, CER, RDL, 10, 000 PF, 05, 50V	C79	EA	1
82-00024-010	CAP, CER, 2.2UF, 20 50V, 2SP	C8,9	EA	2
82-00024-020	CAP, CER, 1.0UF, 20 50V	C21	EA	1
82-00028-080	CAP, CER, 0.22UF, 20 50V, 0.1SP	C1920	EA	1
82-00029-010	CAP, CER DIP, 0.1UF 20, 50V, 0.3SP	C5,15,18,23-53, 60,61,63,65,67	EA	72
82-00033-010	CAP, CER, 100 PF, 10, 100V, 0.1SP	C14	EA	1
82-00035-010	CAP, CER , NPO, AX, 1000 PF, 5, 50V	C128	EA	1
82-00039-040	CAP, CER, RDL, 470 PF, OF, 100V, NPO	C129	EA	1
82-02214-310	CAP, CER, 220 PF, 10, 200V	C6,22	EA	2
83-00001-020	CAP, MICA, 3 PF, 1/2 PF, 500V	C88	EA	1
86-00039-010	CAP, ELE, RAD, 100UF, 100V	C1-4	EA	4
87-01064-410	CAP, TAN, 10UF, 10, 20V, RADIAL	C16,17,64,66,89	EA	5
87-01074-410	CAP, TAN, 100UF, 10, 20V, RADIAL	C62,68,70	EA	3
87-02264-610	CAP, TAN, 22UF, 10, 35V, RADIAL	C54-59	EA	6
87-03353-610	CAP, TAN, 3.3UF, 20, 35V	C75-77	EA	3

PARENT PART: 23-55200-013 **FRONT PANEL ASSY, 5200-02**
REF PAGE: C-25 **Rev A**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
25-55200-020	CABLE, XMT/RCV TEL JACK, 5200	CA1	EA	1
25-55200-030	CABLE, CONTRAST/VOLUME, 5200	CA2	EA	1
25-55200-040	CABLE, LCD BACKLITE, 5200	CA3	EA	1
25-55200-050	CABLE, LCD DISPLAY, 5200	CA4	EA	1
27-50034-290	ASSY, KEEPER MOUNTING - 801A	A3	EA	2
34-00085-120	CONN PC MTG 3 PIN	MP20	EA	1
34-00220-020	CONN PC MTG 20 PIN	MP21	EA	1
44-50801-310	RUBBER BUMPER - 801	MP16,25-27	EA	4
44-55200-011	BEZEL, FRONT, 5200-02	MP1	EA	1
44-55200-021	SIDE PANEL, LEFT, 5200-02	MP9	EA	1
44-55200-080	DISPLAY GASKET, 5200	MP11	EA	1
45-55200-010	FRONT PNL/LABEL ASSY, 5200	A1	EA	1
50-44004-210	SCREW-PH, PHIL, 4-40, .250 LG, SS	MP7	EA	4
50-63208-210	SCREW-PH, PHIL, SS, 6-32, .500 LG	MP12	EA	10
50-83204-210	SCREW-PH, 8-32 X 1/4, SS	MP13	EA	2
51-44000-310	KEPNUT, 4-40, SS	MP22	EA	4
52-40000-310	WASHER, FLAT, NO. 4, .209 OD, .032T, SS	MP23	EA	4
52-00035-010	WASHER , FLAT, FI, NO. 6, .260 OD, .063T	MP18	EA	10
52-00043-010	WASHER, FLAT, NY, NO. 4, .280 OD, .030T	MP10	EA	4
52-00050-010	WASHER, INT, TOOTH, SS, NO. 4, .263 OD	MP8	EA	4
53-00142-010	BINDING POST -15A, SLDR, TERM, RED	MP4	EA	1
53-00142-030	BINDING POST -15A, SLDR, TERM, GRN	MP5	EA	1
53-00142-050	BINDING POST -15A, SLDR, TERM, BLK	MP6	EA	1
54-00076-010	FOOT, TIP UP STAND	MP17,28	EA	2
54-00133-010	KNOB, 14.5 MM, BLK, 1/8 SHAFT	MP24	EA	1
54-00133-020	KNOB, 14.5 MM, BLK, 1/4 SHAFT	MP2	EA	1
54-00134-010	KNOB CAP, 14.5 MM KNOBS, BLK	MP3,30	EA	2
54-00135-010	NUT COVER FOR 14.5 MM KNOBS	MP19,29	EA	2
64-00136-010	LCD DISPLAY, 20 X 16 CHAR	A2	EA	1

PARENT PART: 25-55200-020 **CABLE, XMIT /RECEIVE TEL JACK, 5200**
REF PAGE: C-26 **Rev D**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
34-00077-180	CONN, SHELL, RCPT, 18 POS, .156 SP	1	EA	1
34-00072-010	CONN CONTACT, 18-24 AWG	2	EA	16
34-00437-010	CONN, CABLE SHIELD, .345 TIN BLUE	7	EA	5
34-00448-010	CONN, 310 TEL JACK	3	EA	4
37-00141-800	CABLE, SHIELDED, 2 X 24 AWG 600V	4	IN	34
37-06000-550	TUBING, HEAT SHRINK, 3/16	8	IN	9
42-00252-010	CABLE TIE, MARKER, .75 DIA	5	EA	1
53-00141-060	TERMINAL, LUG, SOLDER, NO. 6, LK	6	EA	3

PARENT PART: 25-55200-030
REF PAGE: C-27

CABLE, CONTRAST/VOLUME, 5200
Rev B

CXR PART NO.	DESCRIPTION	REF	UM	QTY
34-00077-080	CONN HOUSING RCPT, 8 POS, .156 SP	1	EA	1
34-00072-010	CONN CONTACT, 18-24 AWG	2	EA	8
42-00003-010	CABLE TIE, .75 DIA	5	EA	5
42-00252-010	CABLE TIE, MARKER, .75 DIA	6	EA	1
79-00160-011	RES, VAR, PNL, 1 T, 10K, 1/2W, 10%	R3	EA	1
79-00178-010	RES, VAR, W/SWITCH, 10K, 1/2W, 10%	R4	EA	1

PARENT PART: 25-55200-040
REF PAGE: C-28

CABLE, LCD BACKLITE, 5200
Rev A

CXR PART NO.	DESCRIPTION	REF	UM	QTY
34-00077-020	CONN HOUSING RCPT, 2 POS, .156 SP	1	EA	1
34-00072-010	CONN CONTACT, 18-24 AWG	2	EA	2
34-00437-010	CONN, CABLE SHIELD, .345 TIN BLUE	6	EA	2
34-00472-080	CONN HOUSING RCPT, 3 POS, .10 SP	4	EA	1
34-00473-010	CONN CONTACT FEMALE	5	EA	2
37-00141-800	CABLE, SHIELDED, 2 COND, 24 AWG	3	IN	7
42-00252-010	CABLE TIE, MARKER, .75 DIA	7	EA	1

PARENT PART: 25-55200-050
REF PAGE: C-29

CABLE, LCD DISPLAY, 5200
Rev A

CXR PART NO.	DESCRIPTION	REF	UM	QTY
34-00442-060	CONN, IDC RCPT, 20 POS	1	EA	2
37-00053-800	CABLE, FLAT, .050 SP, 20 X 28 AWG	2	IN	6
42-00292-010	KEY, POLARIZING, CONNECTOR	3	EA	2

PARENT PART: 26-55200-021 **REAR PANEL ASSY 5200-02 (W/BATTERIES)**
REF PAGE: C-30 **Rev B**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
25-55200-060	CABLE, SPEAKER, 5200	CA1	EA	1
25-55200-090	WIRE HARNESS, SPRING, 5200	CA4,5,6	EA	3
25-55200-140	CABLE, GROUNDING, 5200-02	CA3	EA	1
25-55200-170	CABLE, FAN, 5200-02	CA2	EA	1
34-00072-010	CONTACT 18-24 AWG	MP23	EA	2
34-00077-020	CONN HOUSING RCPTCLE, 2POS, .156	P4	EA	1
34-00453-010	MODULE-AC PWR W/FIL 150 FCC	MP17	EA	1
42-00248-010	BUMPER-RECESSED 15/16 IN X 5/8 IN	MP10,31-33	EA	4
44-00017-010	FINGER GUARD, FLIGHT 60 FANS	MP5	EA	1
44-55200-041	REAR PANEL, 5200-02 (W/ BATTERY)	MP6	EA	1
44-55200-110	BATT HOLDER, 3 (MOD)	MP1,2	EA	2
44-55200-120	BATT HOLDER, 4 (MOD)	MP3	EA	1
44-55200-170	BRKT, BAT TUBE SUPPORT, 5200	MP27	EA	1
50-44006-210	SCREW-PH, PHIL, 4-40, .375LG, SS	MP26	EA	3
50-44022-210	SCREW-PH, PHIL, 4-40X1, .375 LG, SS	MP14	EA	4
50-83208-210	SCREW-PH, PHIL, CD, 8-32, .500 LG, SS	MP12	EA	4
51-44000-310	KEPNUT, 4-40, SS	MP13	EA	14
51-63200-310	KEPNOT, 6-32, SS	MP21	EA	2
52-00050-010	WASHER, FLAT, NO.4, SS	MP16	EA	4
52-00051-010	WASHER-INT, TOOTH, SS, NO.4, .263 OD	MP15	EA	4
52-00051-030	WASHER LOCK, SPLIT 4, SS	MP28	EA	3
52-60000-310	WASHER, FLAT, NO.6, SS	MP24	EA	2
52-80000-040	WASHER SPLIT ST NO.8, SS	MP11	EA	4
53-00190-010	STANDOFF, HEX, 8-32 X 3/4 LONG, AL, BLK	MP9	EA	4
54-00132-010	SPRING, COMPRESSION, 5200	MP30	EA	3

PARENT PART: 26-55200-060 **CABLE, SPEAKER, 5200**
REF PAGE: C-31 **Rev A**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
34-00072-010	CONTACT, 18-24 AWG	2	EA	2
34-00077-020	CONN, HOUSING, RCPT, 2 POS	1	EA	1
35-00031-010	SPEAKER, 8 OHM, 50 MM X 40 MM	3	EA	1
37-00021 -100	WIRE, TWIST, 2 X 24 GA, 7 X 32, BLK/RED	4	IN	6
42-00252-010	CABLE TIE, MARKER, .75 DIA	5	EA	1

PARENT PART: 25-55200-090 — **WIRE HARNESS, SPRING, 5200**
REF PAGE: C-32 — **Rev A**

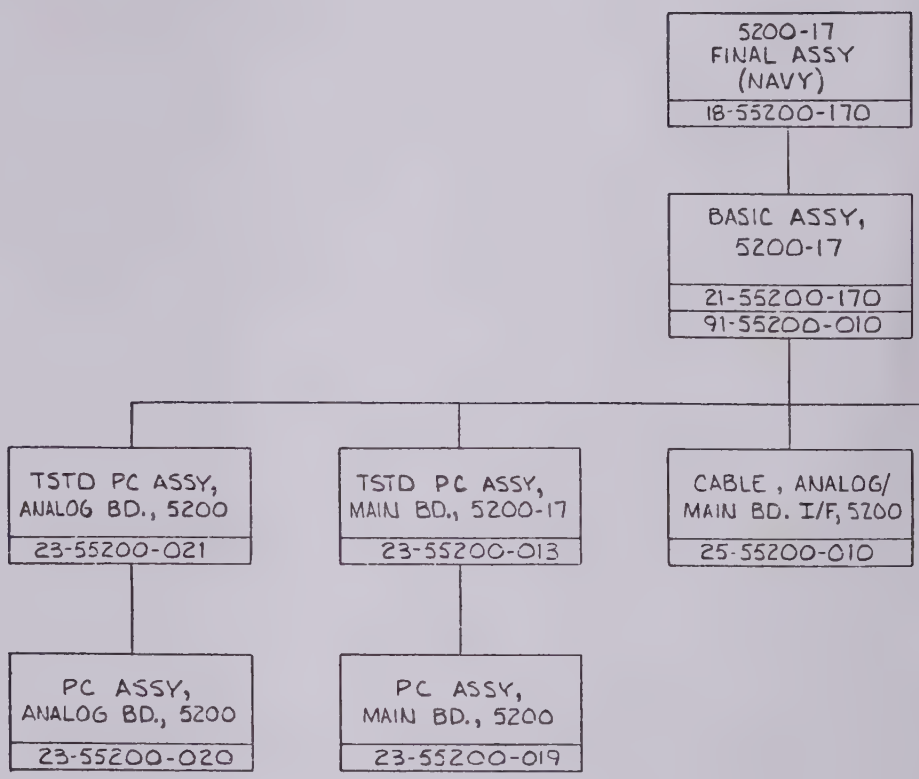
CXR PART NO.	DESCRIPTION	REF	UM	QTY
54-000123-010	SPRING, CONTACT, BATTERY HOLDER	1	EA	1

PARENT PART: 25-55200-140 — **CABLE, GROUNDING, 5200-02**
REF PAGE: C-33 — **Rev A**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
53-00052-080	TERMINAL, RING, INSUL, 22-18 AWG	1	EA	2

PARENT PART: 25-55200-170 — **CABLE, FAN, 5200-02**
REF PAGE: C-34 — **Rev A**

CXR PART NO.	DESCRIPTION	REF	UM	QTY
31-00076-010	FAN, 24VDC, 13CFM	1	EA	1
34-00072-010	CONTACT, CRIMP STYLE, 18-24 AWG	2	EA	2
34-00077-020	CONN., LOCKING, 2 POS.	3	EA	1
42-00003-010	CABLE TIE, .75 DIA	4	EA	1
42-00252-010	CABLE TIE, MARKER, .75 DIA	5	EA	1



NOTES — UNLESS OTHERWISE SPECIFIED.

DWG. NO	SH	REV
96-55200-001	1	A2

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
—	A	PRE-PRODUCTION		
—	A1	RELEASE PER DRN# 5200-02	3/29/93	M.E. Seeley
—	A2	REPLACED 25-55200-0701-080 WITH 25-55200-010	6/23/93	M.E. Seeley

- FRONT PANEL ASSEMBLY, 5200-02 — 26-55200-011
- REAR PANEL ASSY, 5200-02, W/BATTERIES — 26-55200-021
- CABLE, XMT/RECV TEL JACK, 5200 — 25-55200-020
- CABLE, SPEAKER, 5200 — 25-55200-060
- CABLE, CONTRAST/VOLUME, 5200 — 25-55200-030
- CABLE, FAN, 5200-02 — 25-55200-170
- CABLE, LCD BACKLIGHT, 5200 — 25-55200-040
- WIRE HARNESS, SPRING, 5200 — 25-55200-090
- CABLE, LCD DISPLAY, 5200 — 25-55200-050
- CABLE, GROUNDING, 5200-02 — 25-55200-140

ITEM NO	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

—	—	5200-17
—	NEXT ASSY	USED ON
QTY PER	APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
MATERIAL
FINISH
DO NOT SCALE DRAWING

CONTRACT NO

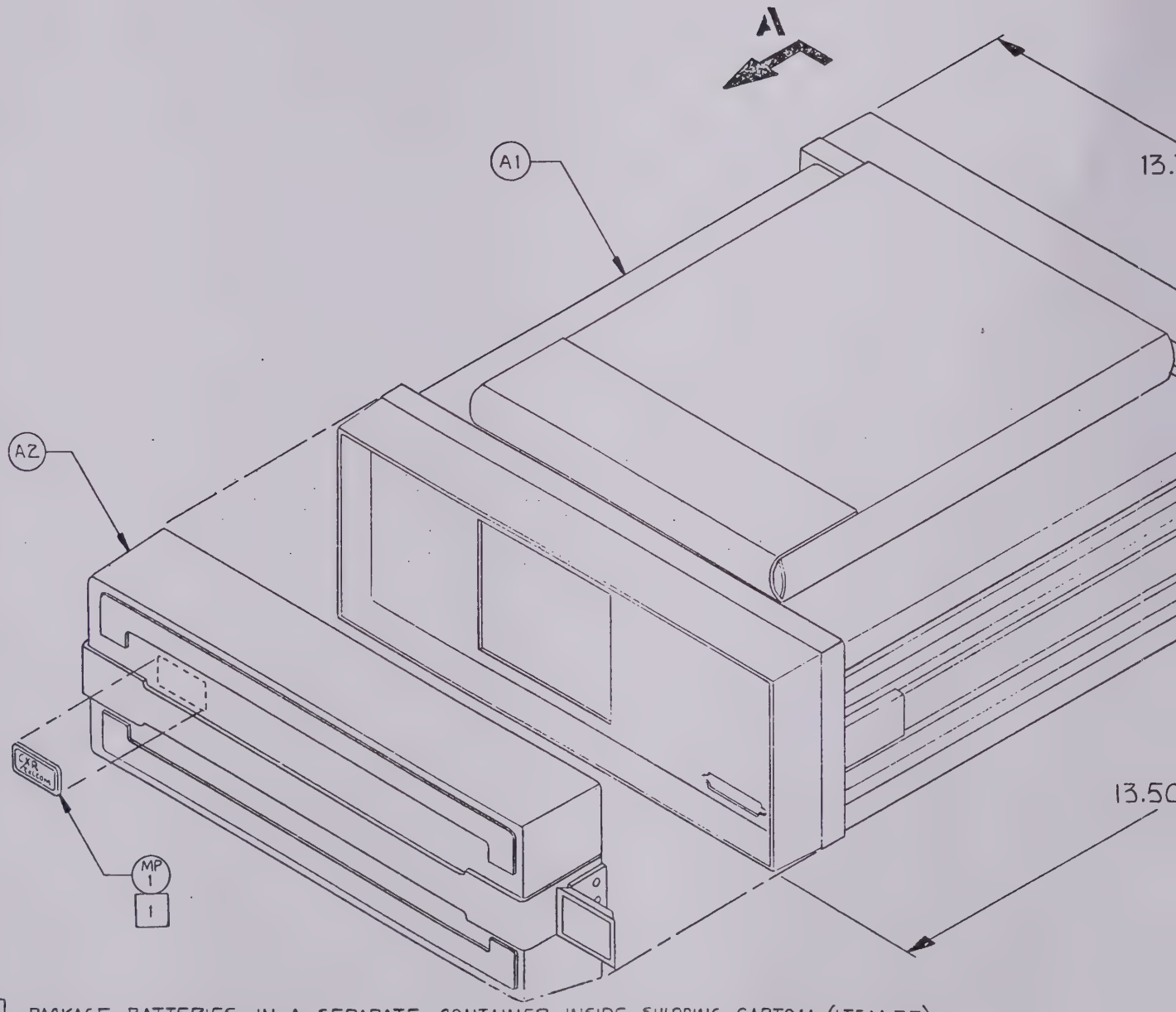
APPROVALS	DATE
DRAWN M. E. SEELEY	11-10-92
CHECKED M.C. Seeley	11/10/92
QA	
PROJECT ENG	3/17/93
ENG MGR	3/23/93

QUANTUM
921 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

PRODUCT TREE, 5200-17

SIZE	FSCM NO	DWG NO	REV
D	—	96-55200-001	A2

SCALE NONE SHEET 1 OF 1



4 PACKAGE BATTERIES IN A SEPARATE CONTAINER INSIDE SHIPPING CARTON (ITEM 75).

3. ITEMS 20 & 902 (NOT SHOWN) TO BE SHIPPED WITH UNIT.

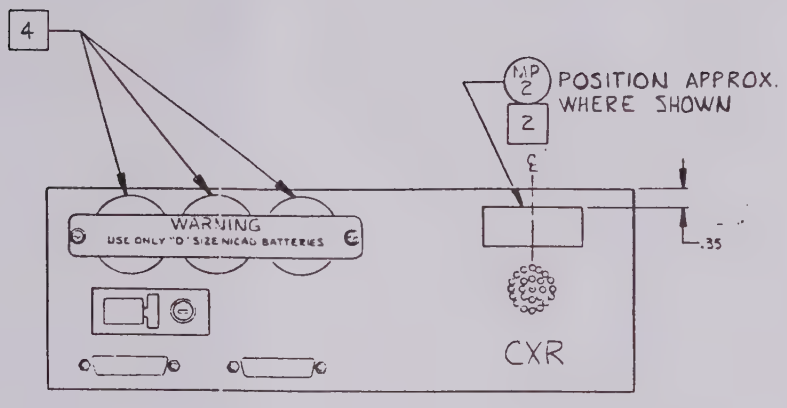
2 COMPLETE PRODUCT CODE ON LABEL (MP 2) BY WRITING "17" AFTER "5200-" WITH A INDELIBLE MARKING PEN. CLEAN APPROPRIATE AREA OF REAR PANEL (A4) WITH ISOPROPYL ALCOHOL PRIOR TO ADHERING LABEL.

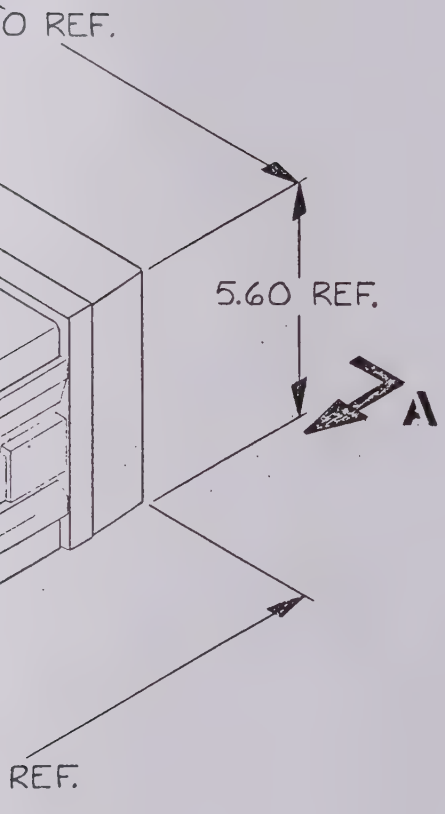
1 CLEAN APPROPRIATE AREA OF DUST COVER (A2) WITH ISOPROPYL ALCOHOL PRIOR TO ADHERING LABEL (MP 1).

NOTES — UNLESS OTHERWISE SPECIFIED:

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PRE-PRODUCTION		
	A1	RELEASE PER DRN* 5200-02	3/23/93	M E Seeley





VIEW A-A

REF. 18-55200-170
PAGE B-2

SEE SEPARATE B/M 18-55200-170

ITEM NO	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± ——— DECIMALS .XX ± ——— .XXX ± ——— ANGLES ± ———
MATERIAL
FINISH
DO NOT SCALE DRAWING

CONTRACT NO

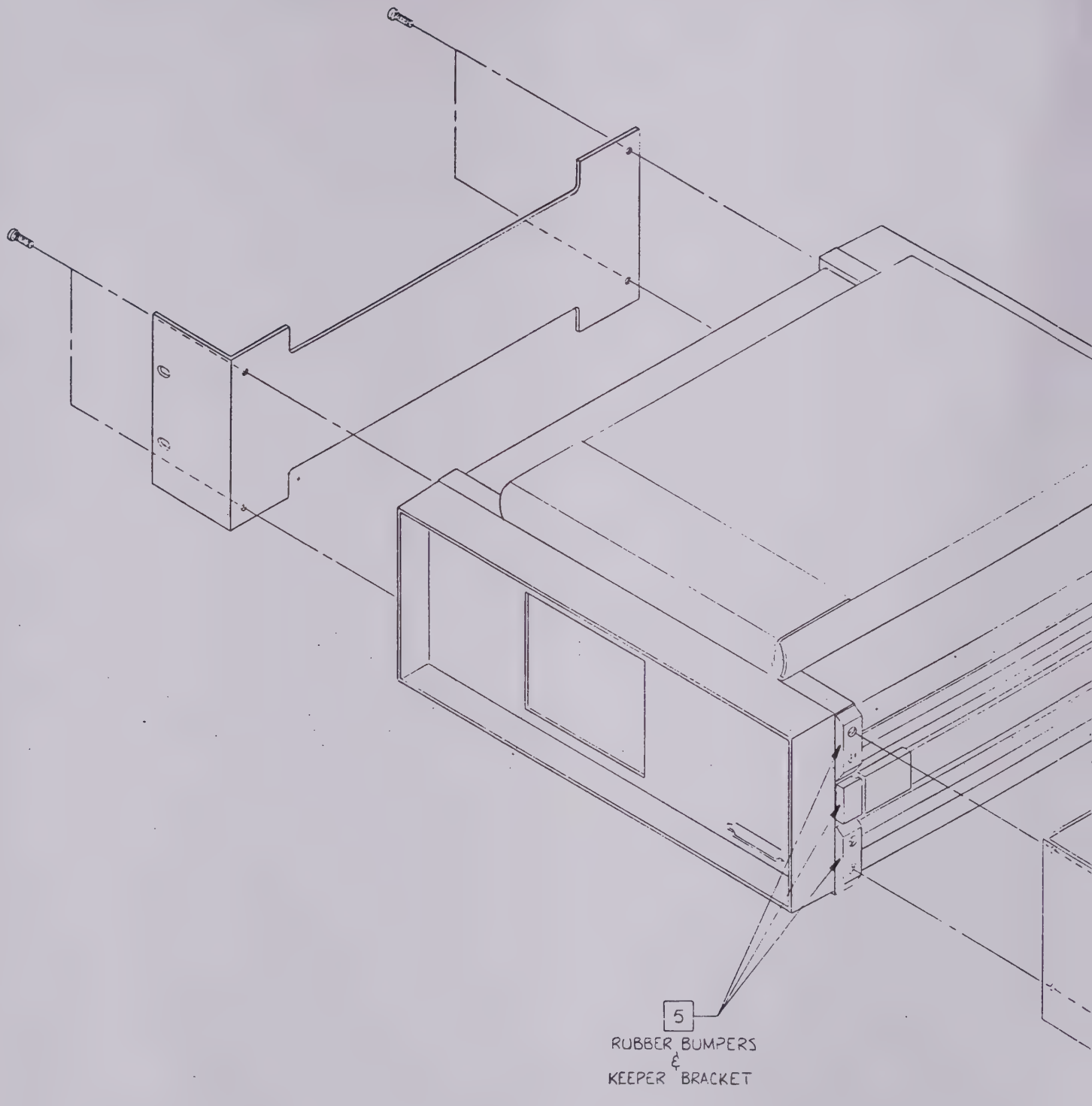
APPROVALS	DATE
DRAWN M.E SEELEY	11-12-92
CHECKED M.E Seeley	11/12/92
QA	
PROJECT NO	
ENG MANAGER John Slater	3/23/93

CXR Telcom
821 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

5200-17
FINAL ASSEMBLY (NAVY)

SIZE D | FSCM NO | DWG NO 18-55200-170 | REV A1
SCALE NONE | SHEET 1 OF 2

		5200-17
NEXT ASSY		USED ON
QTY PER	APPLICATION	



5 TO INSTALL RACK ADAPTER BRACKETS: 1) REMOVE SIDE RUBBER BUMPERS (8 TOTAL, 4 EACH SIDE) AND KEEPER BRACKETS (2 TOTAL, 1 EACH SIDE); 2) RETAIN 8 OF THE 16 MOUNTING SCREWS FOR INSTALLATION OF BRACKETS AS SHOWN.

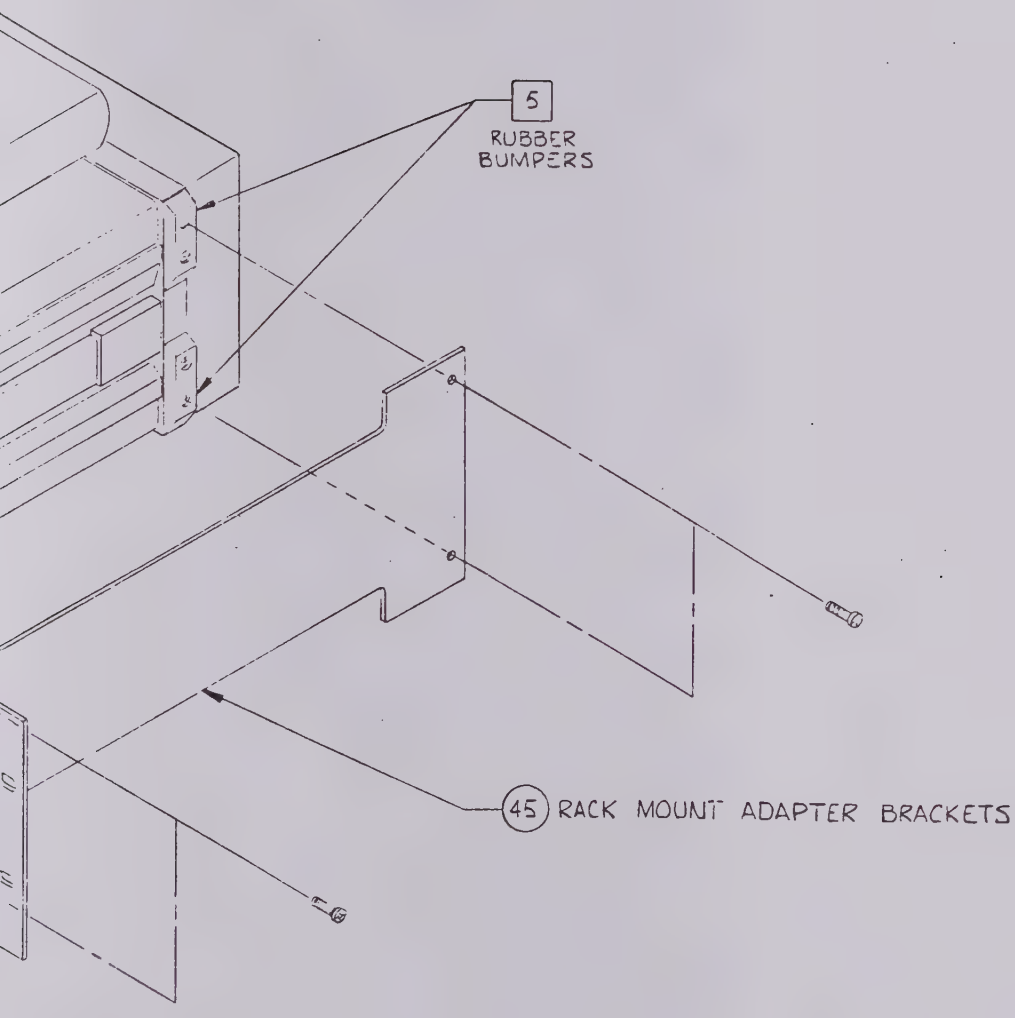
NOTES — UNLESS OTHERWISE SPECIFIED:

DWG NO	SH	REV
18-55200-170	2	A1

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED

FOR CUSTOMER USE ONLY



ITEM NO	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
				PARTS LIST	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN M. SEELEY	2-26-93
CHECKED M. Seeley	3-8-93
QA	
PROJECT MG	
ENG MANAGER	

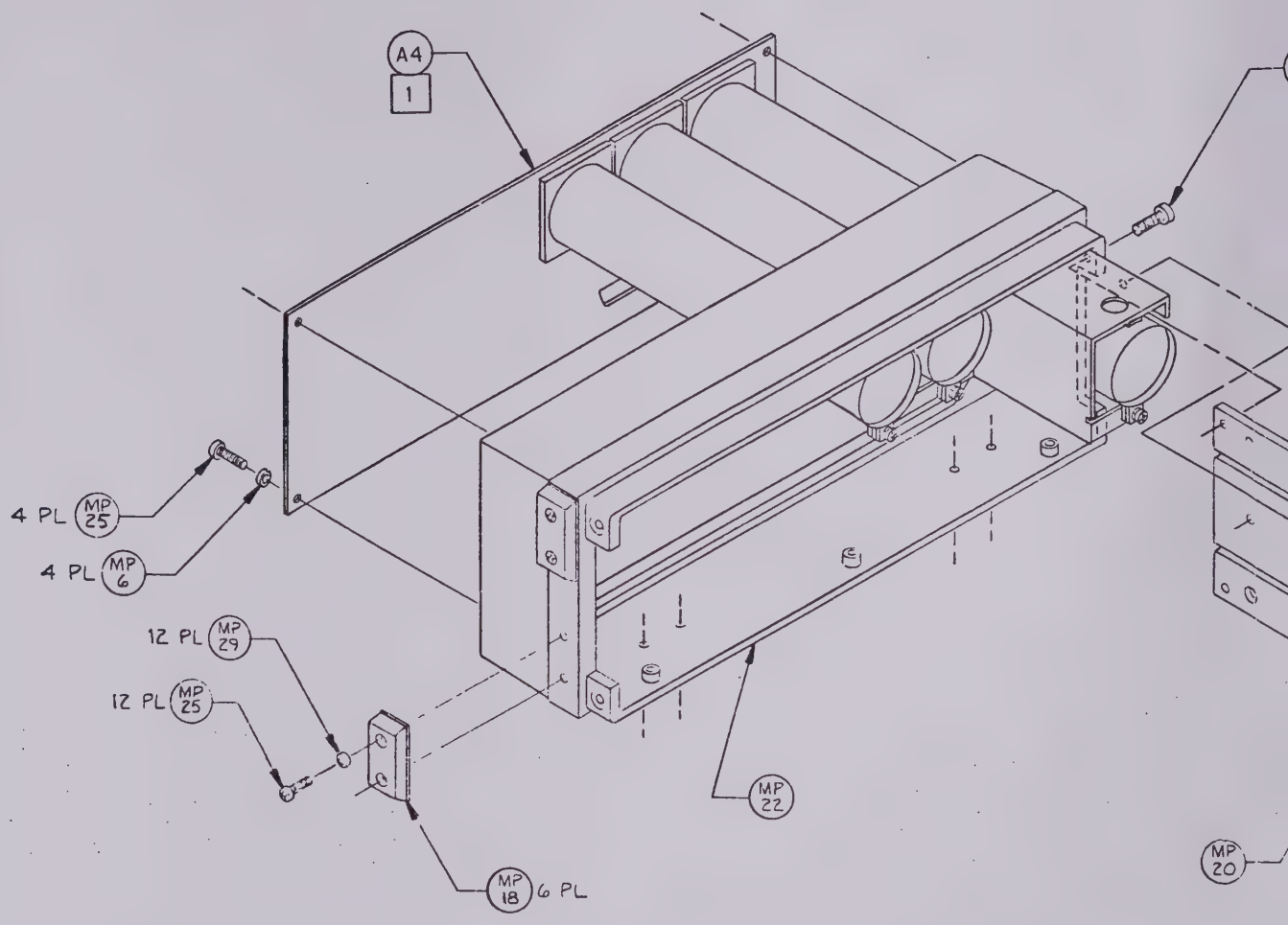
QXR Telecom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

5200-17
FINAL ASSEMBLY (NAVY)

SIZE	FSCM NO	DWG NO	REV
D		18-55200-170	A1

SCALE NONE SHEET 2 OF 2

QTY PER	APPLICATION	
	NEXT ASSY	USED ON
		5200



1 DO NOT SECURE REAR PANEL ASSEMBLY (A4) UNTIL PARTS ARE ASSEMBLED PER SHEET 2.

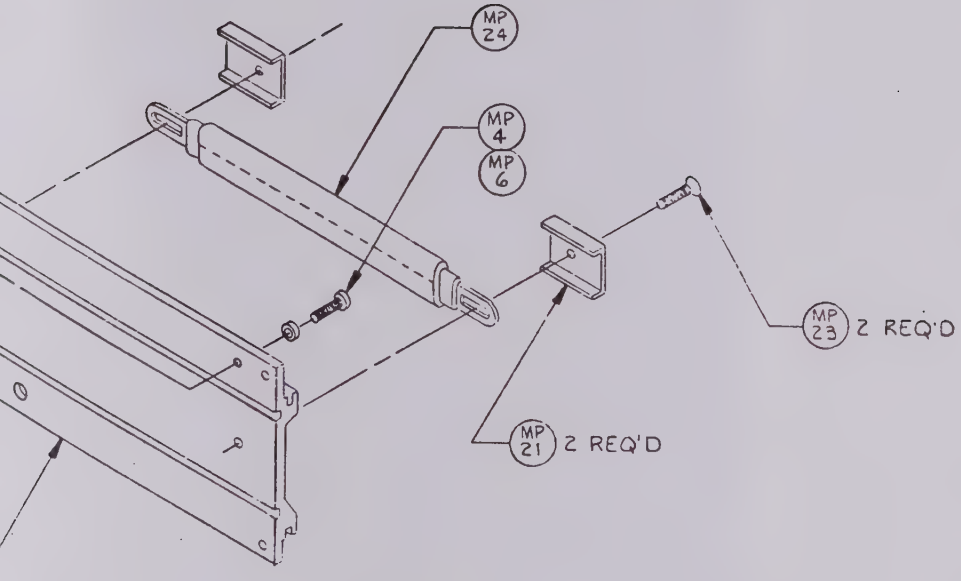
NOTES — UNLESS OTHERWISE SPECIFIED:

DWG NO	SH	REV
21-55200-170	1	B

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PRE-PRODUCTION		
	A1	RELEASE PER DRN# 5200-02	3/23/93	M.E. Seeley
	A2	ITEM 60 WAS 44-55200-060, PER ECO# 7508	6/15/93	M.E. Seeley
	B	REVISED PER ECO# 7618	6/16/93	M.E. Seeley

(MP 3) 2 PL



REF. 21-55200-170
PAGE B-3

SEE SEPARATE B/M 21-55200-170

ITEM NO	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± —— DECIMALS .XX ± —— .XXX ± —— ANGLES ± ——

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN M. E. SEELEY	11-10-92
CHECKED M.E. Seeley	11/12/92
QA	
PROJECT ENG	3.19.93
ENG MANAGER	3/23/93

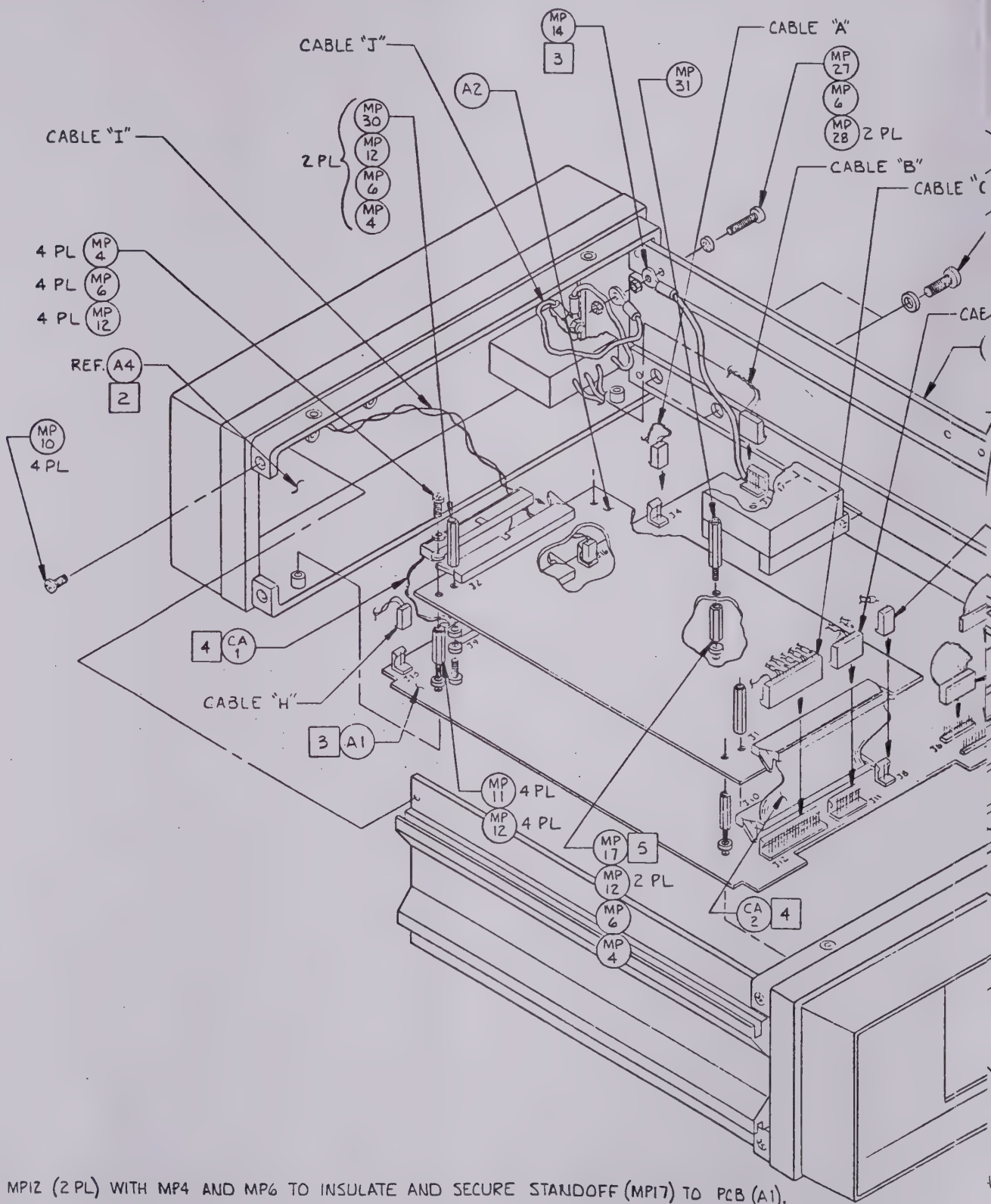
QXR Telecom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

BASIC ASSEMBLY, 5200-17

SIZE	FSCM NO	DWG NO	REV
D		21-55200-170	B

SCALE NONE SHEET 1 OF 3

——	——	5200-17
——	NEXT ASSY	USED ON
QTY PER	APPLICATION	



5 USE MP12 (2 PL) WITH MP4 AND MP6 TO INSULATE AND SECURE STANDOFF (MP17) TO PCB (A1).

4 FOLD SLACK OF CA1 AND CA2 TOWARD CENTER OF UNIT.

3 INSTALL A GROUND WIRE FROM J17 TO SIDE PANEL (USE 6 INCH LONG, 22 AWG BUNCH TINNED, GREEN WIRE, CXR P/N 37-22555-020) AS INDICATED.

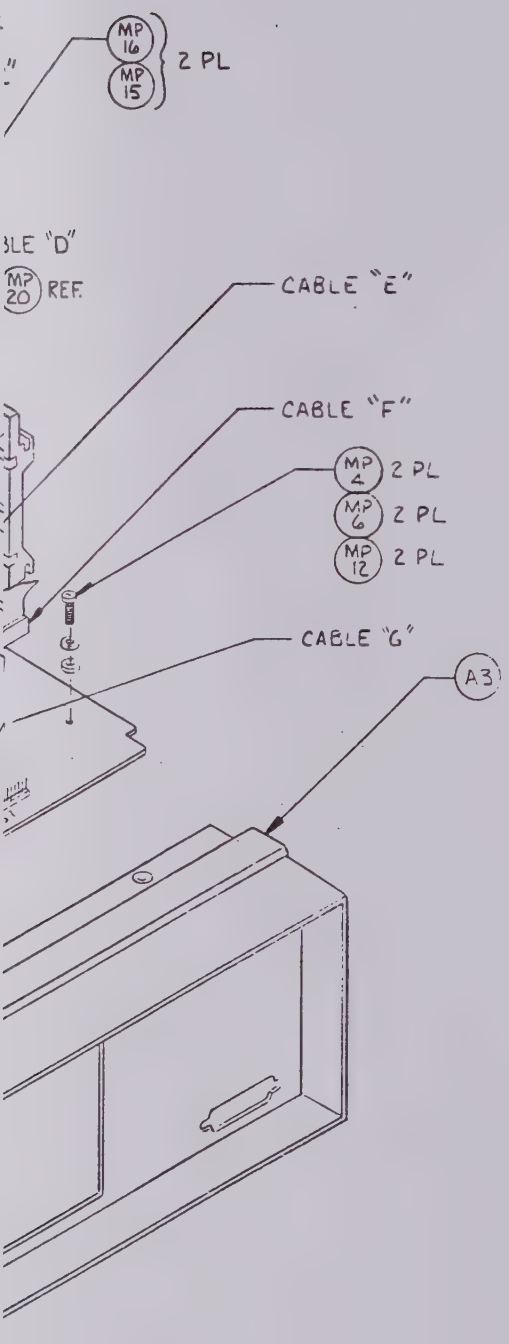
2 REAR PANEL ASSEMBLY (A4) MUST BE DETACHED FROM REAR BEZEL TO INSTALL PC ASSEMBLIES AND CABLE ASSEMBLIES. BATTERY HOLDERS ARE OMITTED FROM THIS SHEET FOR EASE OF ASSEMBLY.

NOTES — UNLESS OTHERWISE SPECIFIED:

DWG NO 21-55200-170 SH 2 REV B

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED



CABLE CONNECTION TABLE		
CABLE	FROM	TO
CA 1	A1 J9	A2 J2
CA 2	A1 J10	A2 J1
"A"	A4 2 PIN MOLEX (BATTERY HOLDERS)	A1 J4
"B"	A4 5 PIN MOLEX (AC MODULE)	A1 J1
"C"	A3 18 PIN MOLEX (BINDING POSTS & JACKS)	A1 J12
"D"	A8 8 PIN MOLEX (POTENTIOMETERS)	A1 J11
"E"	A3 2 PIN MOLEX (FRONT PANEL PCB)	A1 J8
"F"	A3 15 PIN MOLEX (MEMBRANE PANEL)	A1 J7
"G"	A3 20 PIN RIBBON CABLE (FRONT PANEL PCB)	A1 J6
"H"	A4 2 PIN MOLEX (SPEAKER)	A1 J13
"I"	A4 2 PIN MOLEX (FAN ASSY)	A1 J16
"J"	A4 GROUND WIRE (REAR PANEL)	MP 20 GROUNDING SCREW (SIDE EXTRUSION)

SEE SEPARATE B/M 21-55200-170

ITEM NO	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
				PARTS LIST	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN M.E. SEELEY	11-10-92
CHECKED	
QA	
PROJECT ENG.	
ENG MANAGER	

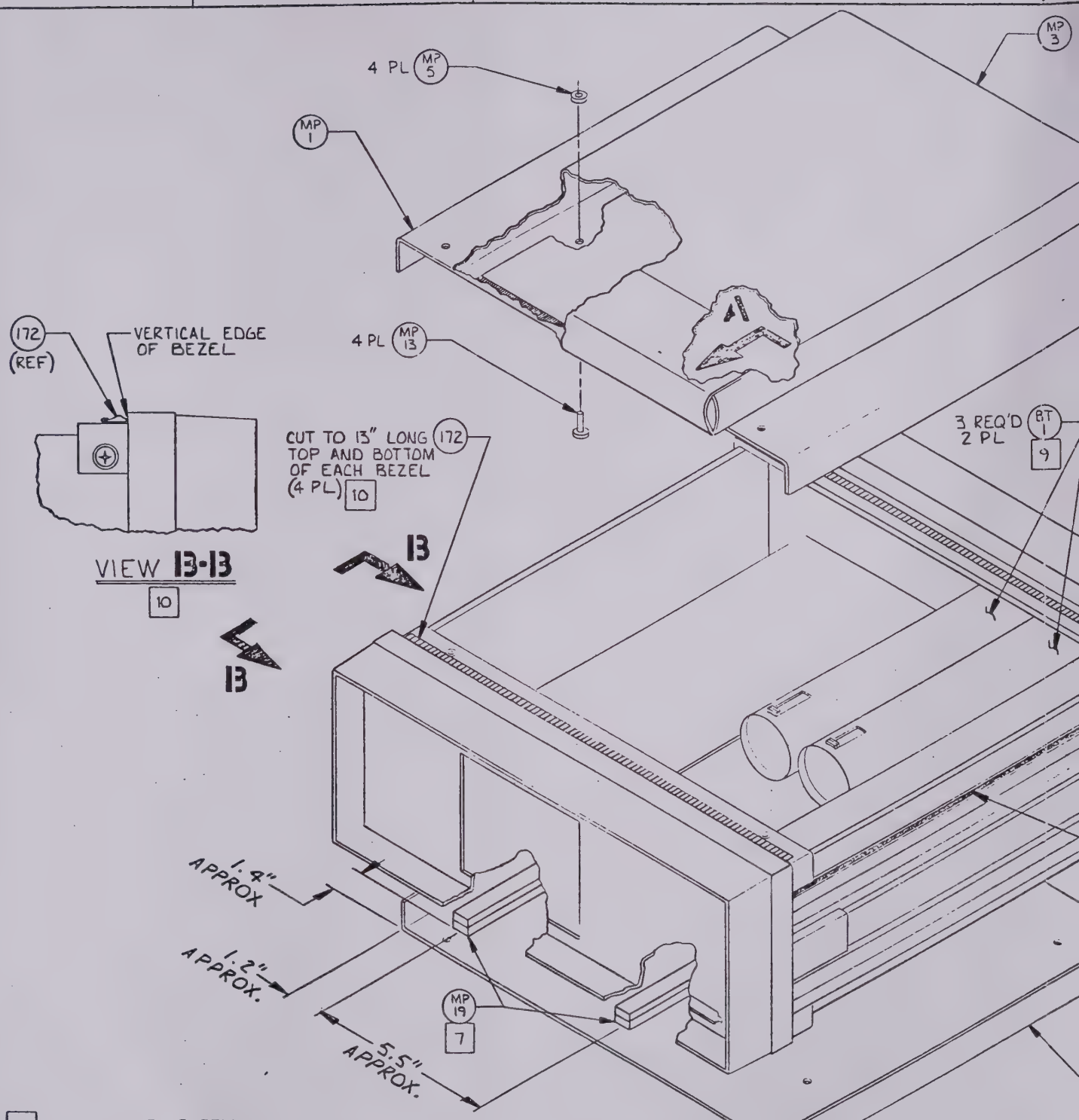
CXR Telecom
821 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

BASIC ASSEMBLY, 5200-17

SIZE D | FSCM NO | DWG NO 21-55200-170 | REV B

SCALE NONE | SHEET 2 OF 3

		5200-17
	NEXT ASSY	USED ON
QTY. PER	APPLICATION	



10 CLEAN BEZEL SURFACE, REMOVE ADHESIVE BACKING OF ITEM 172 AND INSTALL AGAINST VERTICAL EDGE OF BEZEL AS SHOWN IN VIEW B-B.

9 COAT ALL EXPOSED METAL ON BATTERIES (BT1) WITH CHEMTRONICS "GOLD GUARD UV" (P/N CB01V); TH INSTALL CHARGED BATTERIES FOR TESTING AND BURN-IN, AS INDICATED.

8 REMOVE FUSE COVER FROM AC RECEPTACLE, INSERT F1 (2 PL) AND REPLACE COVER. SET VOLTAGE SELECTOR SWITCH TO 110V.

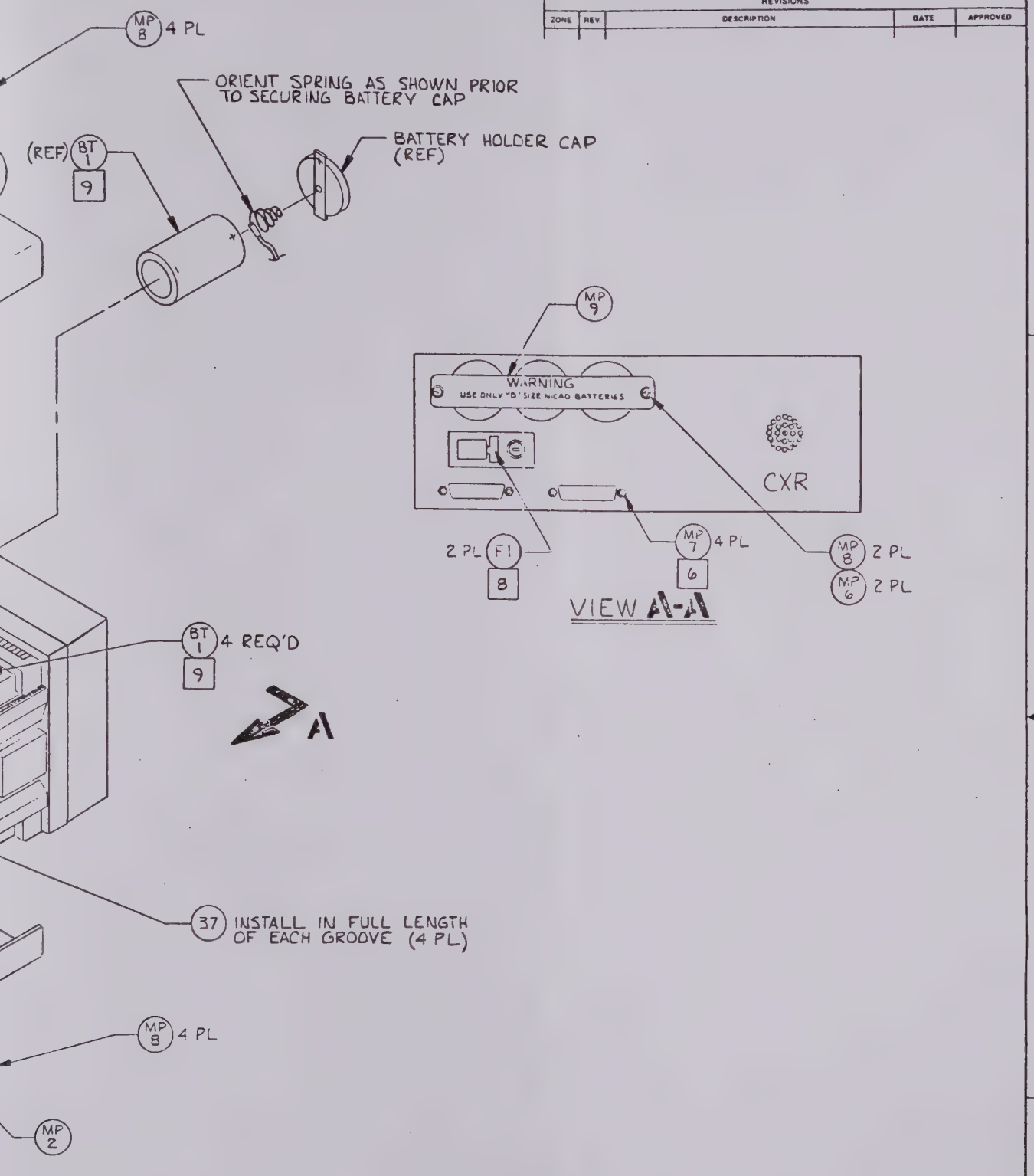
7 CUT MP19 (P/N 42-00268-020) INTO 6" LENGTHS. APPLY DOUBLE-THICKNESS, 2 PLACES, AND INSTALL PER DIMENSIONS SHOWN.

6 REMOVE AND DISCARD HARDWARE SUPPLIED WITH RS-232 CONNECTOR. INSTALL NEW HARDWARE (MP7) WHERE SHOWN.

NOTES — UNLESS OTHERWISE SPECIFIED:

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED


MP 8 4 PL
ORIENT SPRING AS SHOWN PRIOR TO SECURING BATTERY CAP
BATTERY HOLDER CAP (REF)
(REF) BT 1 9
MP 9
WARNING
USE ONLY "D" SIZE NiCAD BATTERIES
CXR
2 PL F1 8
MP 7 4 PL 6
MP 8 2 PL
MP 6 2 PL
VIEW A1-A1
BT 1 4 REQ'D 9
A
37 INSTALL IN FULL LENGTH OF EACH GROOVE (4 PL)
MP 8 4 PL
MP 2

SEE SEPARATE B/M 21-55200-170

PARTS LIST

ITEM NO	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±
MATERIAL
FINISH

APPROVALS	DATE
DRAWN M E. SEELEY	11-10-92
CHECKED	
QA	
PROJECT ENG	
ENG MANAGER	

CONTRACT NO

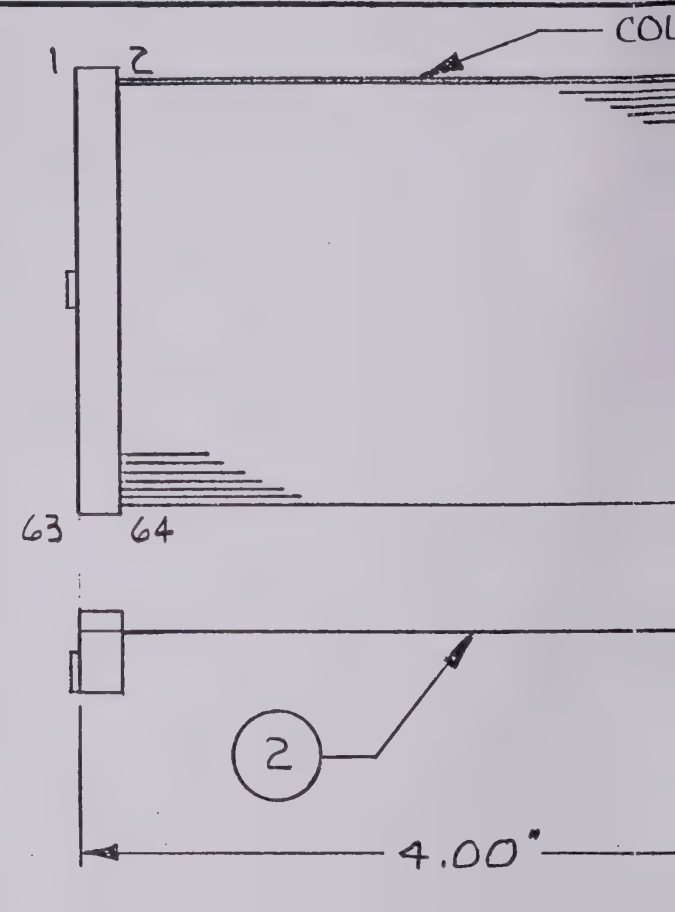
CXR Telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

BASIC ASSEMBLY, 5200-17

SIZE D | FSCM NO | DWG NO 21-55200-170 | REV B
SCALE NONE | SHEET 3 OF 3

DO NOT SCALE DRAWING

QTY. PER	APPLICATION	
		5200-17
	NEXT ASSY	USED ON



3. INSTALL CONNECTORS WITH PIN 1 TO COLORED CONDUC

[2] STAMP SIDE OF CONNECTOR WITH CXR P/N 25-55200-010 AND CURRENT REVISION LEVEL USING PERMANENT CONTRASTING INK.

[1] USE PARTS SPECIFIED OR EXACT EQUIV. ONLY.

NOTES- UNLESS OTHERWISE SPECIFIED:

		5200
	NEXT ASSY	USED ON
QTY. PER	APPLICATION	

2	4"
1	2
ITEM NO.	QTY REQD

UNLESS OTHERW
DIMENSIONS AR
TOLERANCES A
FRACTIONS D
± ——
.X
.X

MATERIAL

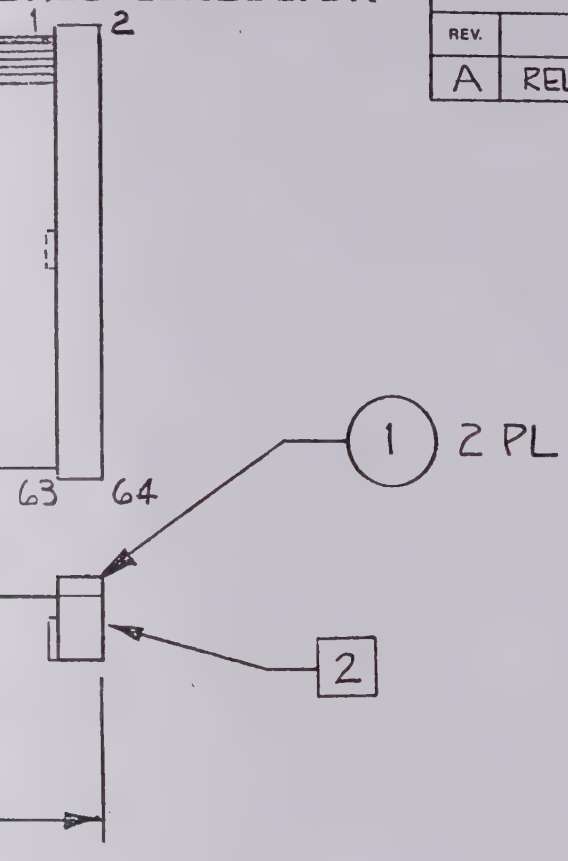
FINISH

DO NOT

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A49291

DWG. NO. 25-55200-010 SH 1 REV. A

ORED CONDUCTOR



REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	REL. PER DRN #5200	1-18-90	M.E. Lackey

REF. 25-55200-010
PAGE B-4

PURCHASED ASSY

TOR.

PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
37-00159-800	RIBBON CABLE, 64 COND. 28 AWG.	3M-3539/64
34-00568-010	CON., RECEPT., 64 PIN CENTER BUMP	3M-7964-6500EC

PARTS LIST

SE SPECIFIED
N INCHES
:
IMALS ANGLES
± .25 ± —
X ±

1

—

CALE DRAWING

CONTRACT NO. —

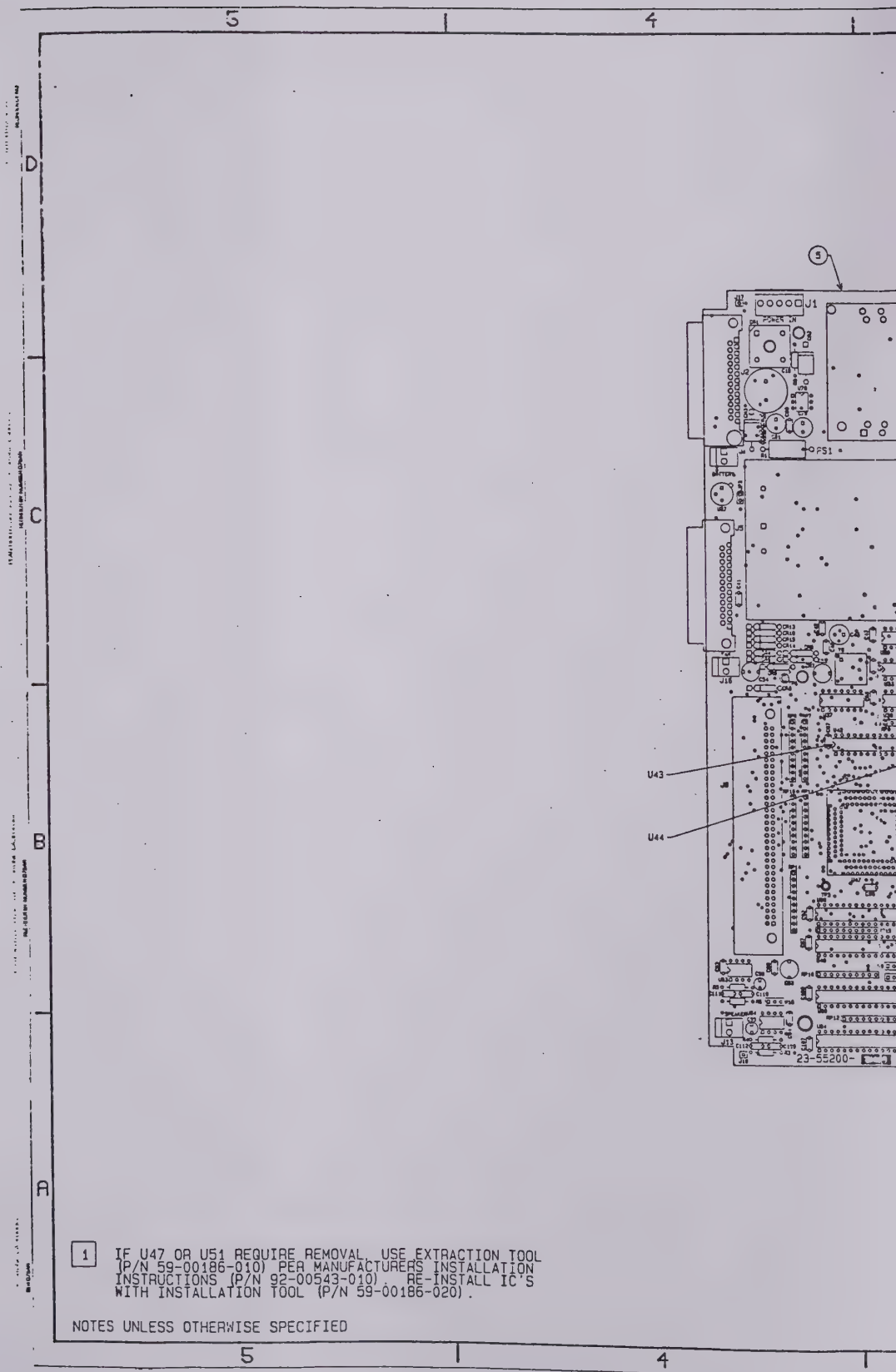
APPROVALS	DATE
DRAWN Tim I.	9-26-89
CHECKED MC Lackey	1-16-90
QA	
PROJECT ENG. L Ls	1-18-90
ENG. MANAGER John Kerth	1/18/90

CXR telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

CABLE,
ANALOG/MAIN BD. I/F, 5200

SIZE	FSCM NO.	DWG. NO.	REV.
B	—	25-55200-010	A

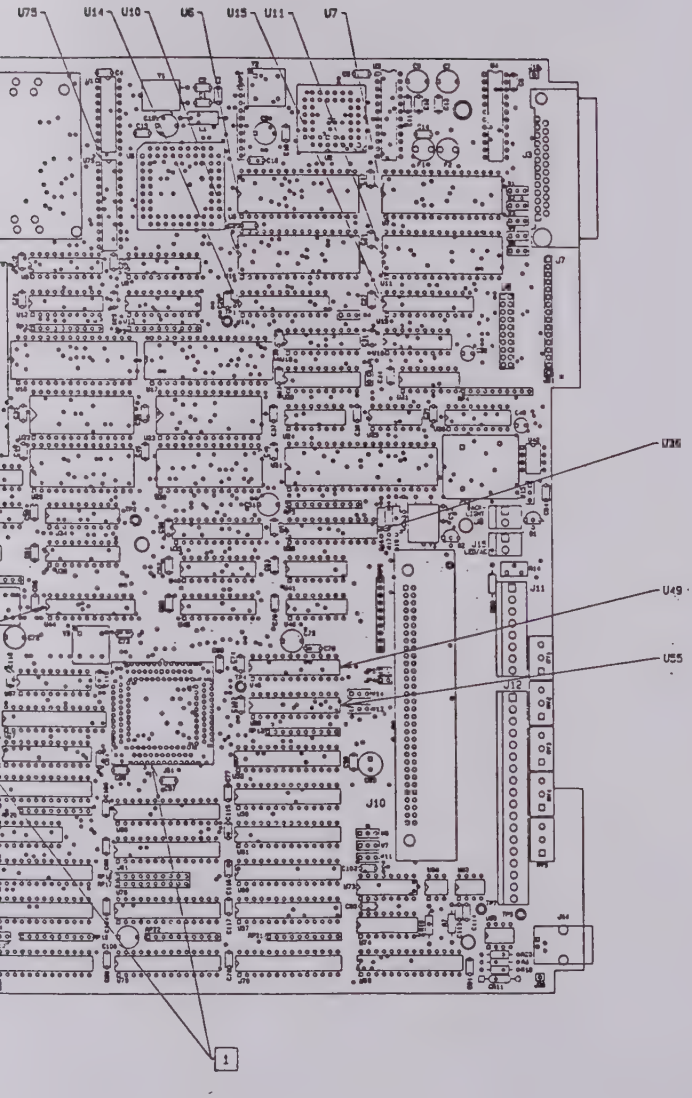
SCALE NONE SHEET 1 OF 1



1 IF U47 OR U51 REQUIRE REMOVAL, USE EXTRACTION TOOL (P/N 59-00186-010) PER MANUFACTURERS INSTALLATION INSTRUCTIONS (P/N 92-00543-010). RE-INSTALL IC'S WITH INSTALLATION TOOL (P/N 59-00186-020).

NOTES UNLESS OTHERWISE SPECIFIED

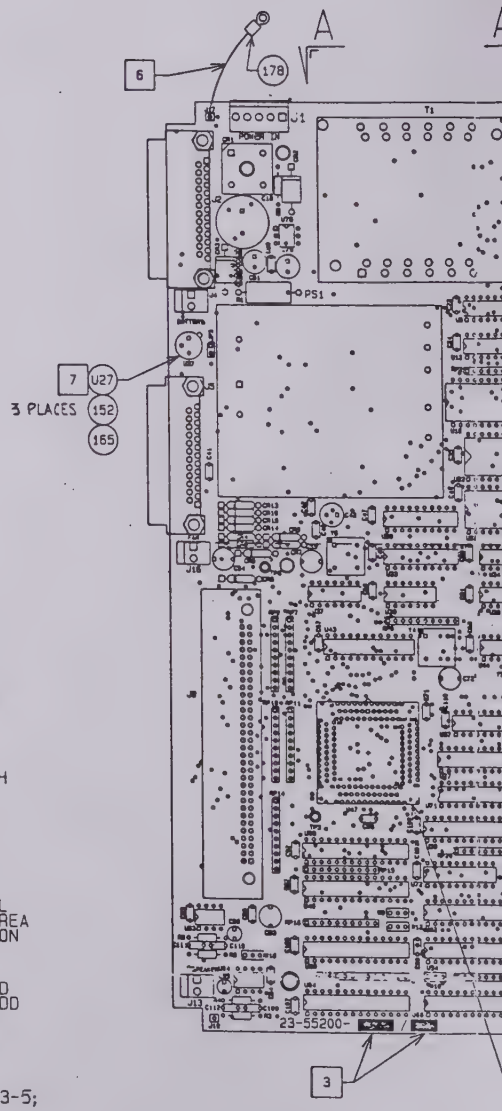
REV		DATE	APPROVED
A	PRE-PRODUCTION		
A1	RELEASE PER DRN" 5200-02	3/23/93	
B	ITEMS 50, 55, 60, & 65 WERE 69-55200-412, 69-55200-422, 69-55200-432, & 69-55200-442, RESPECTIVELY, PER ECO" 7608	6/7/93	



REF. 23-55200-013
PAGE B-5

SEE SEPARATE B/M 23-55200-013

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS (.XX) ± .01 FRACTIONS ± DECIMALS (.XXX) ±.005 ANGLES ± 2°		APPROVALS	DATE	telcon
NEXT ASSY	PRODUCT	DRAWN E.C.HANNETT	2/8/93	
		CHECKED	2/8/93	TESTED, PC ASSEMBLY MAIN BOARD MODEL: 5200-17
		ENGINEER	2/26/93	
		ENG MGR	3/23/93	
		RELEASED		DIST / DWG NO. 23-55200-013 / REV B
				SIZE D / SCALE 1:1 / SHEET 1 OF 1



11 INSTALL U47 AND U51 INTO APROPRIATE SOCKETS USING INSTALLATION TOOL (P/N 59-00186-020) PER MANUFACTURER'S INSTALLATION INSTRUCTIONS (P/N 92-00543-010). IF U47 OR U51 REQUIRE REMOVAL REMOVAL, USE EXTRACTION TOOL (P/N 59-00186-010).

10 INSTALL TRANSFORMER (T1) AND SECURE TO PCB WITH HARDWARE SHOWN PER VIEW A-A.

9 LOAD U55 WITH PIN 1 OF IC AT PIN 1 LOCATION.

8 LOAD U16 AND U17 WITH PIN 1 OF IC AT PIN 3 LOCATION.

7 MOUNT U27 USING ITEM 152 (3 PLACES). INSTALL ITEM 165 USING GE G641 SILICON COMPOUND ON AREA OPPOSITE EXPANSION GROOVE ON TOP OF U27 AND ON ON VANE OF ITEM 165. SEE DETAIL B.

6 PRIOR TO WAVE SOLDER, MASK HOLES FOR J17 AND T1. SECOND OPERATION: HAND SOLDER T1 AND ADD JUMPER TO J17 (USE 6 INCH LONG, 22 AWG BUNCH TINNED, GREEN WIRE, CXR P/N 37-22555-020). CRIMP RING TERMINAL (ITEM 178) TO REMAINING END OF WIRE.

5 DO NOT LOAD THE FOLLOWING COMPONENTS: C3; JP3-5; L1; Q2; R9,16,17; U56-58, 68, 76-84.

4 J8, 11-13, 15, 16 MAY EXCEED .50" HEIGHT, LOAD FLUSH.

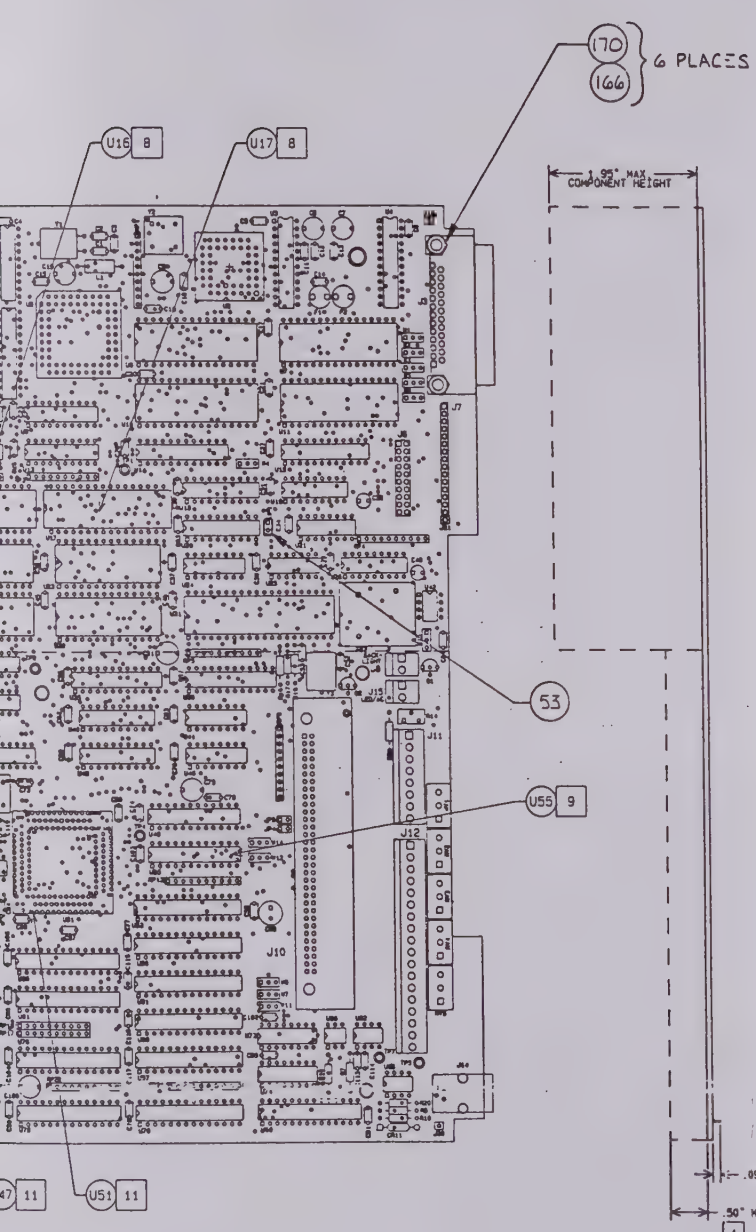
3 MARK WITH DASH NO. "019" AND CURRENT REVISION LEVEL WHERE SHOWN.

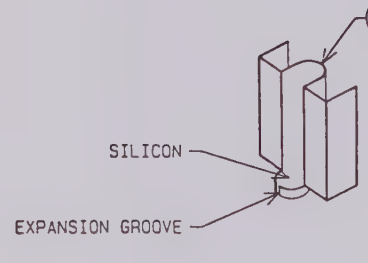
2 SQUARE PAD DENOTES PIN 1 OF DEVICE, CATHODE OF DIODE, POSITIVE END OF CAP, EMITTER OF TRNAS-ISTOR OR GATE OF F.E.T.

1 REFERENCE DRAWINGS: 43-55200-011 FABRICATION
90-55200-019 SCHEMATIC

NOTES UNLESS OTHERWISE SPECIFIED

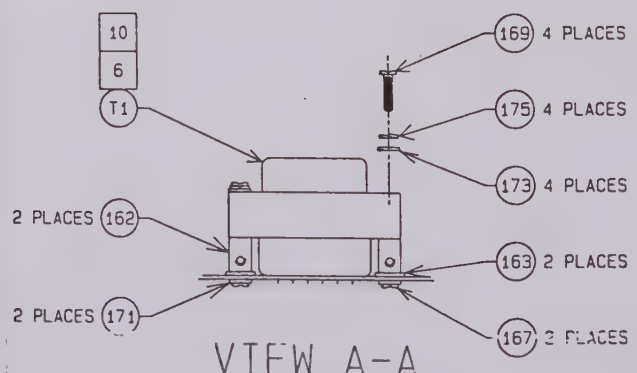
REV		DATE	APPROVED
A	RELEASE PER DRN# 5200-02	3/23/93	





DETAIL B

SCALE: NONE



VIEW A-A

SCALE: NONE

.09" MAX. LEAD LENGTH

.50" MAX COMPONENT HEIGTH

4

REF. 23-55200-019
PAGE B-6

SEE SEPARATE B/M 23-55200-019

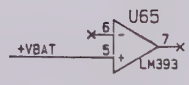
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: DECIMALS (.XX) ± .01 FRACTIONS ± DECIMALS (.XXX) ± .005 ANGLES ± 2°		APPROVALS	DATE	CXR telcom
NEX ASSY	PRODUCT	DRAWN E.C.HANNETT	2/8/93	
		CHECKED	2/8/93	ASSEMBLY, PCB MAIN BOARD MODEL: 5200-17
		ENGINEER	2/26/93	
		ENG MGR	3/23/93	DIST / DWG NO. 23-55200-019 / REV A
		RELEASED		SIZE D / SCALE 1 : 1 / SHEET 1 OF 1

I.C TYPE	VCC	GND	+12V	-12V	REFERENCE DESIGNATOR
74BCT126	14	7			U38
74HCT151	16	8			U41, U46
LT1141	2	24	1	24	U3, U4
74HCT259	16	8			U24, 21
MC34119	6	7			U63, U64
85C30	10	35			U2
74C922	18	9			U19, U26
CY325	40	20			U31
74ACT841	24	12			U35
74ALS573	20	10			U28
74HCT377	20	10			U67, U72
DS1286	28	14			U29
LM393	8	4			U65
75451	8	4			U42
LDA100					U66, 78
7705A	8	4			U62
LM317					U27
56001					U47, 51
CY7C421	28	14			U69, U70
74HCT595	16	8			U73, U74
74674	24	12			U71
71256	28	14			U48, 52, 54, 56-61, 68,
					76, 77, 79-84
74AC04	14	7			U25, U37
DS1245AB	28	14			U16, U17
62256	28	14			U22, 23
173PLD	24	12			U15, 75
ATV750	24	12			U14, 36, 43, 44, 49, 55
80C186	9, 43	26, 60			U5
74ACT573	20	10			U1, 8, 9, 20, 33, 39, 45, 18
27C010	32	16			U6, U7, U10, U11
74ACT245	20	10			U12, U13, U34, U40
82C59	28	14			U30

C D E

REV	DESCRIPTION	ECO	DATE	APPROVED
A	RELEASE PER DRN# 5200-02		3/24/93	

LAST USED	NOT USED
CR12	CR10
C119	C28, 29
F2	
JP5	
J21	
L1	
PS2	
Q2	
RP22	
R20	R12, 13
RV5	
T1	
TP7	
U84	
W15	
Y6	



SPARES

REF. 23-55200-019
PAGE B-6

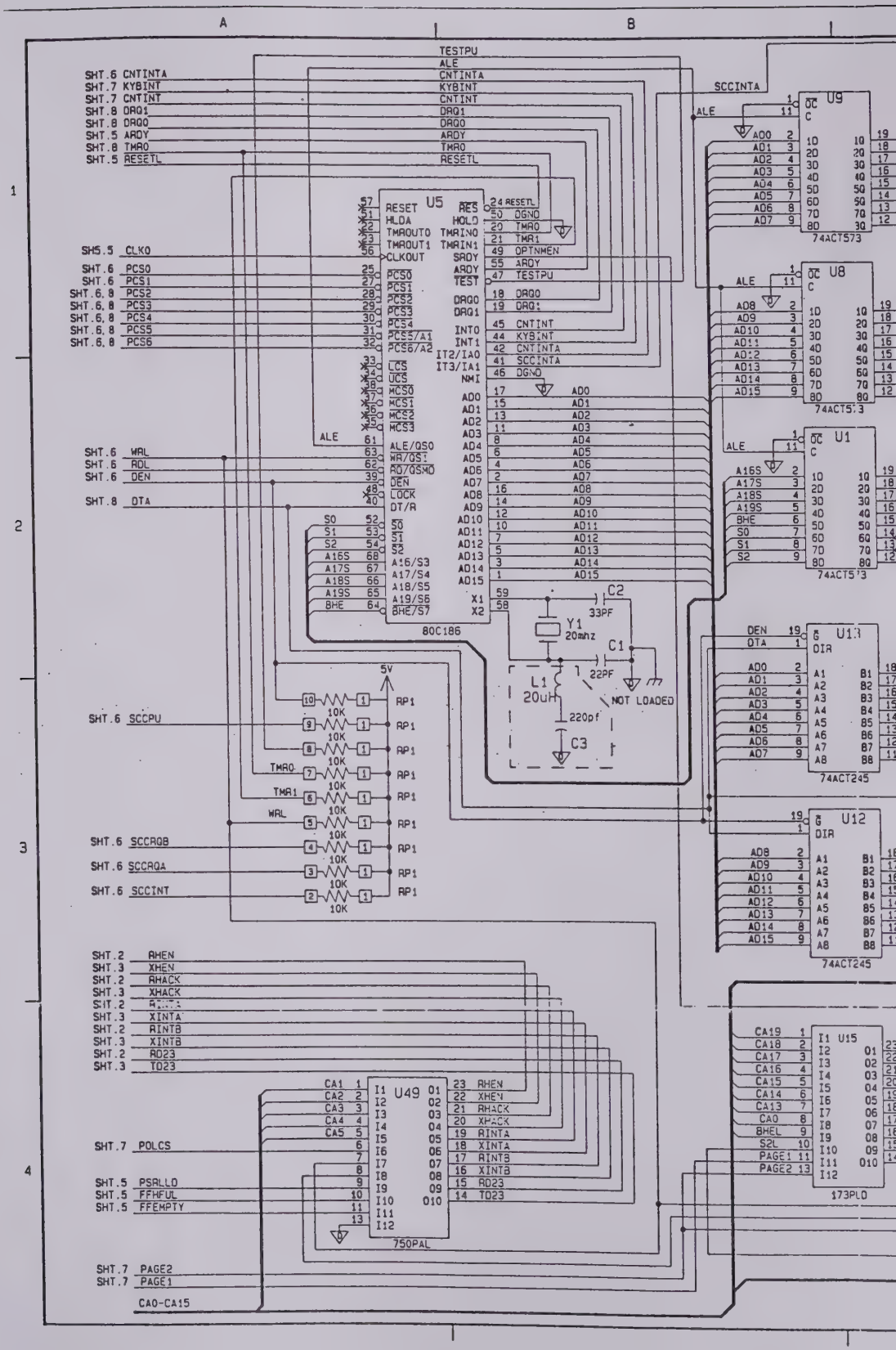
2. ALL RESISTOR VALUES ARE IN OHMS, 1%, 1/8 W.
1. ALL CAPCITOR VALUES ARE IN MICROFARADS.
NOTES: UNLESS OTHERWISE SPECIFIED

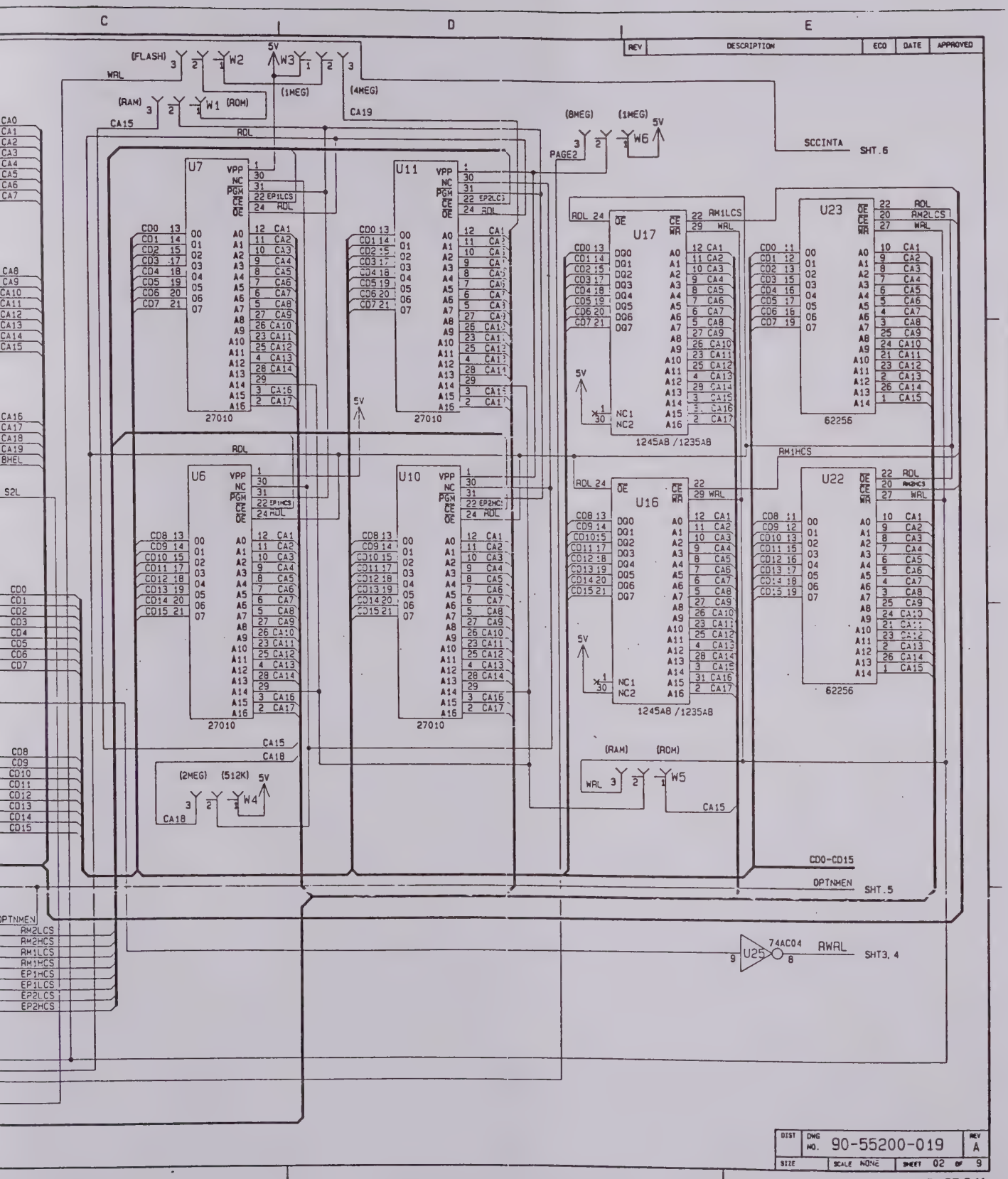
NEXT ASSY	PRODUCT

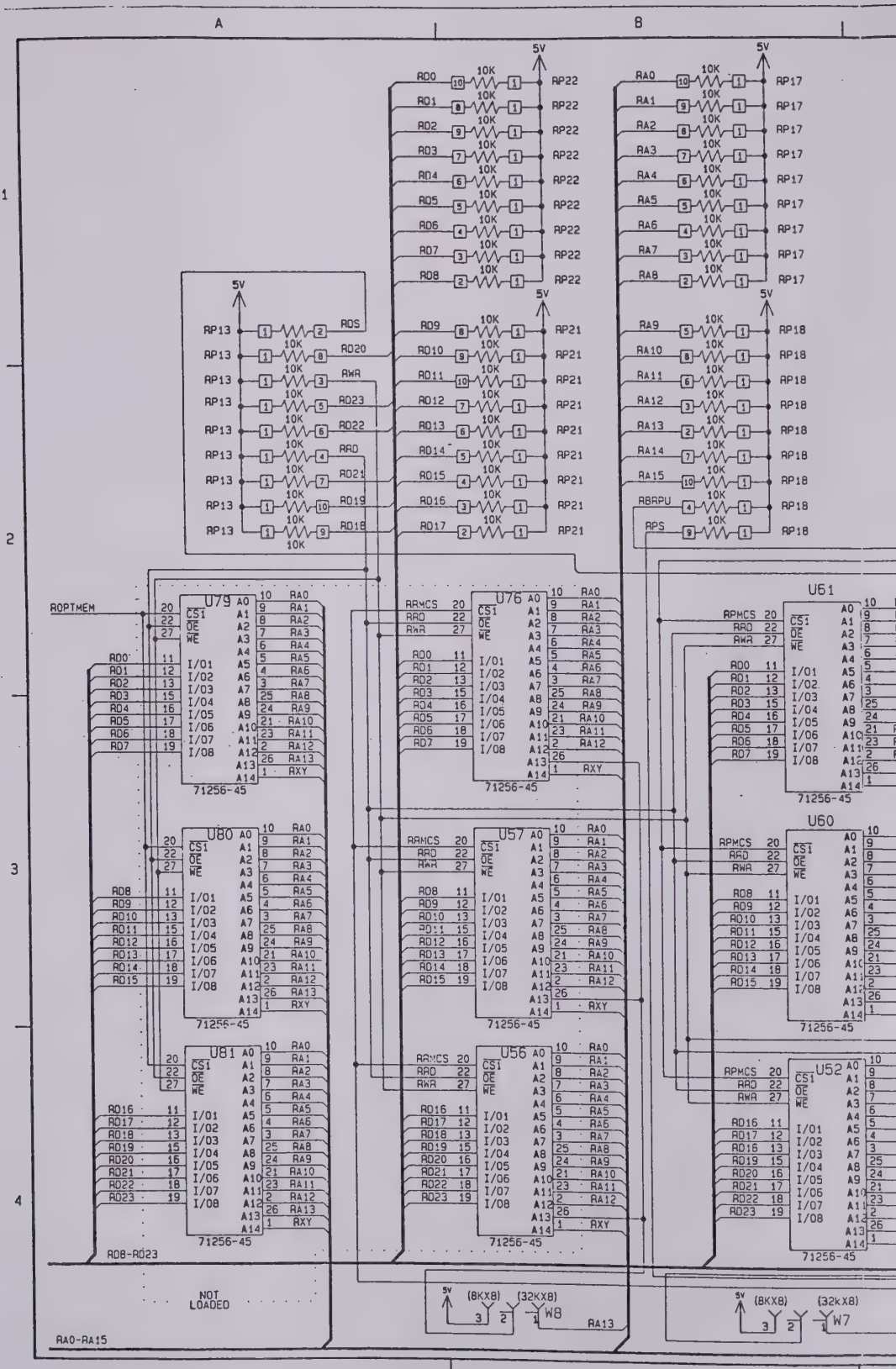
DRAWN E.C.HANNETT 2/4/93
CHECKED JFC 2-15-93
ENGINEER 2/25/93
MANAGER 3/23/93
MFG
Q.A.
SERVICE
RELEASED

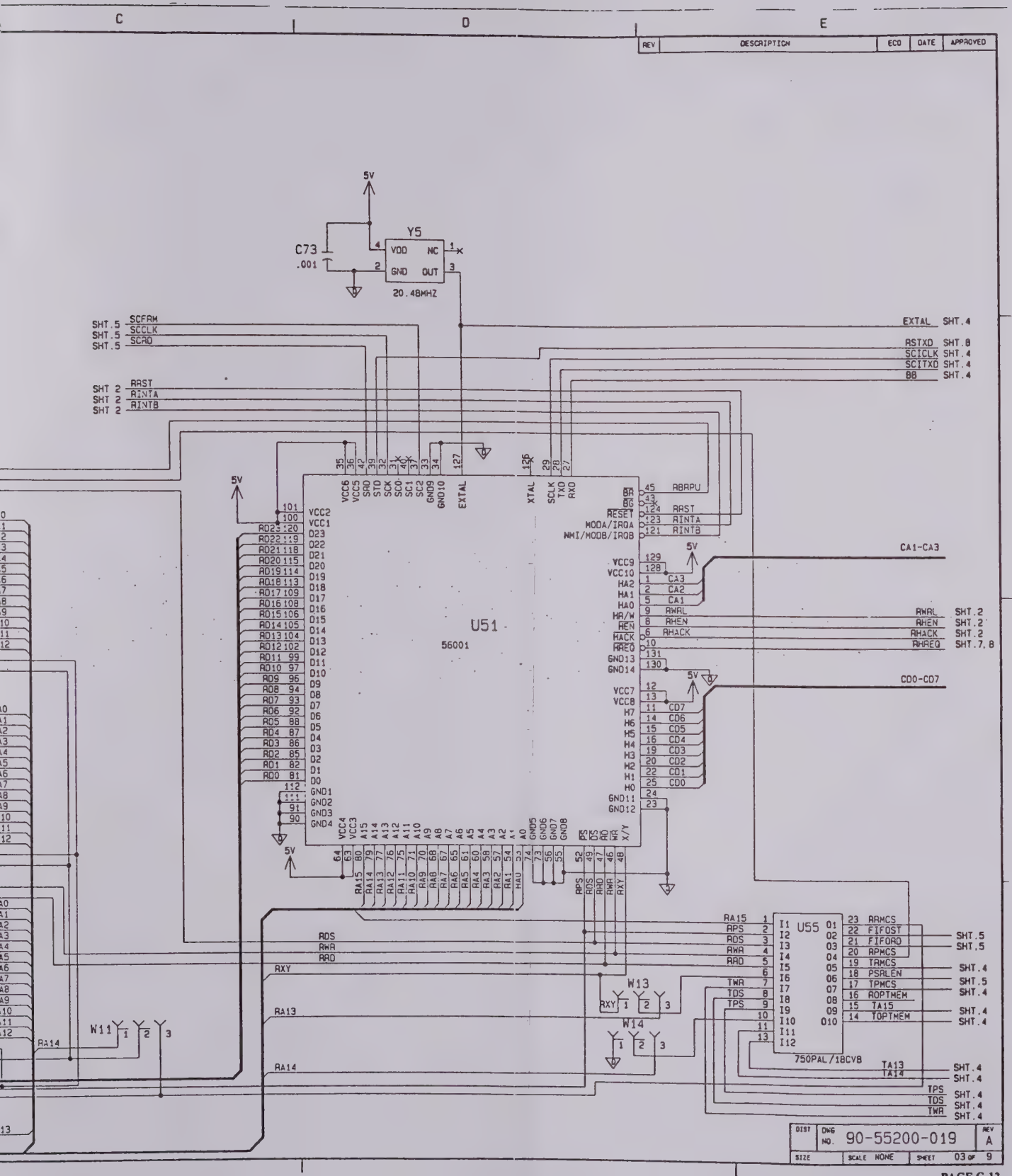
SCHEMATIC
MAIN BAORD
MODEL: 5200

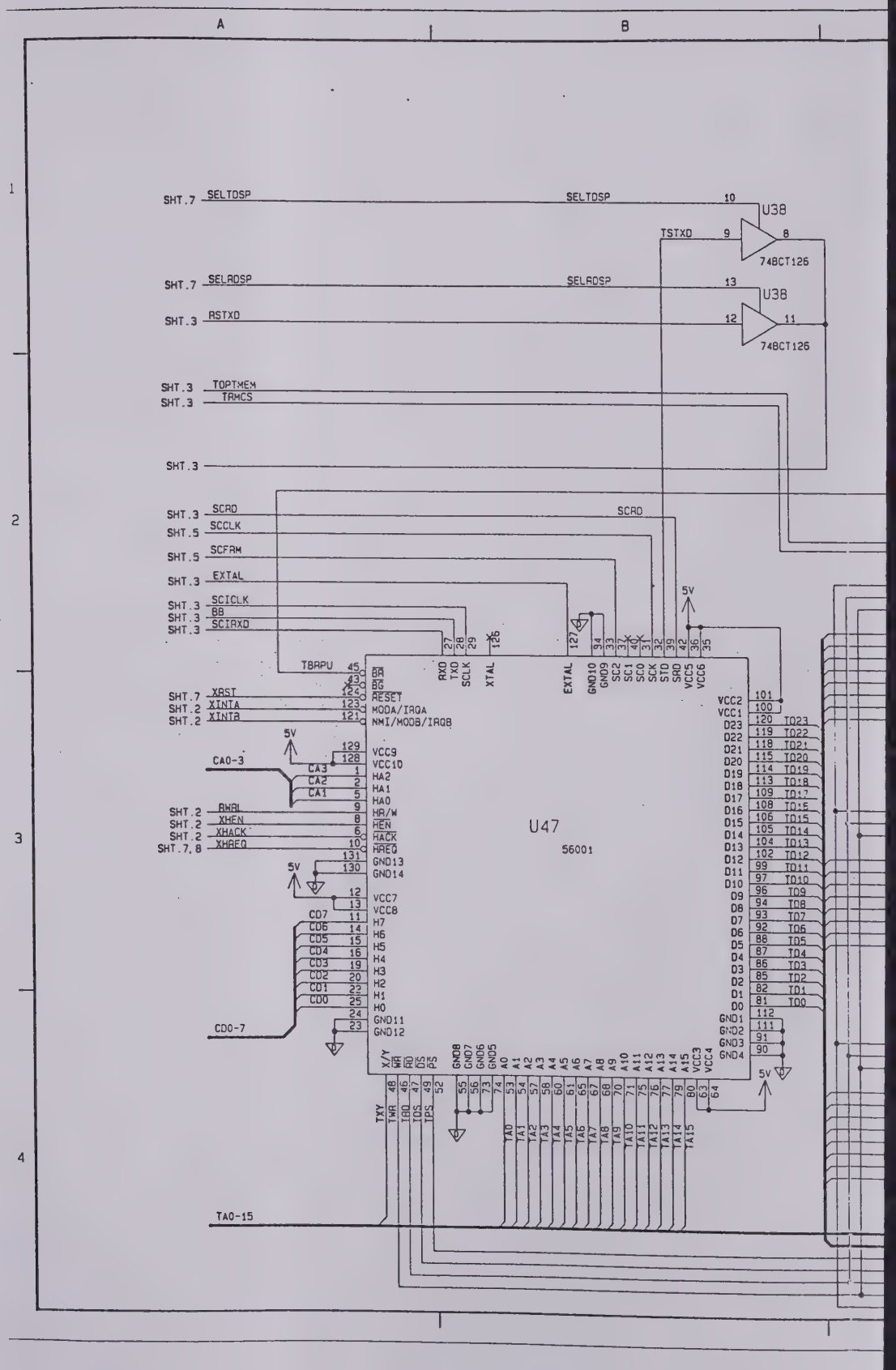
DIST | DWG NO. 90-55200-019 | REV A
SIZE | SCALE NONE | SHEET 01 OF 9

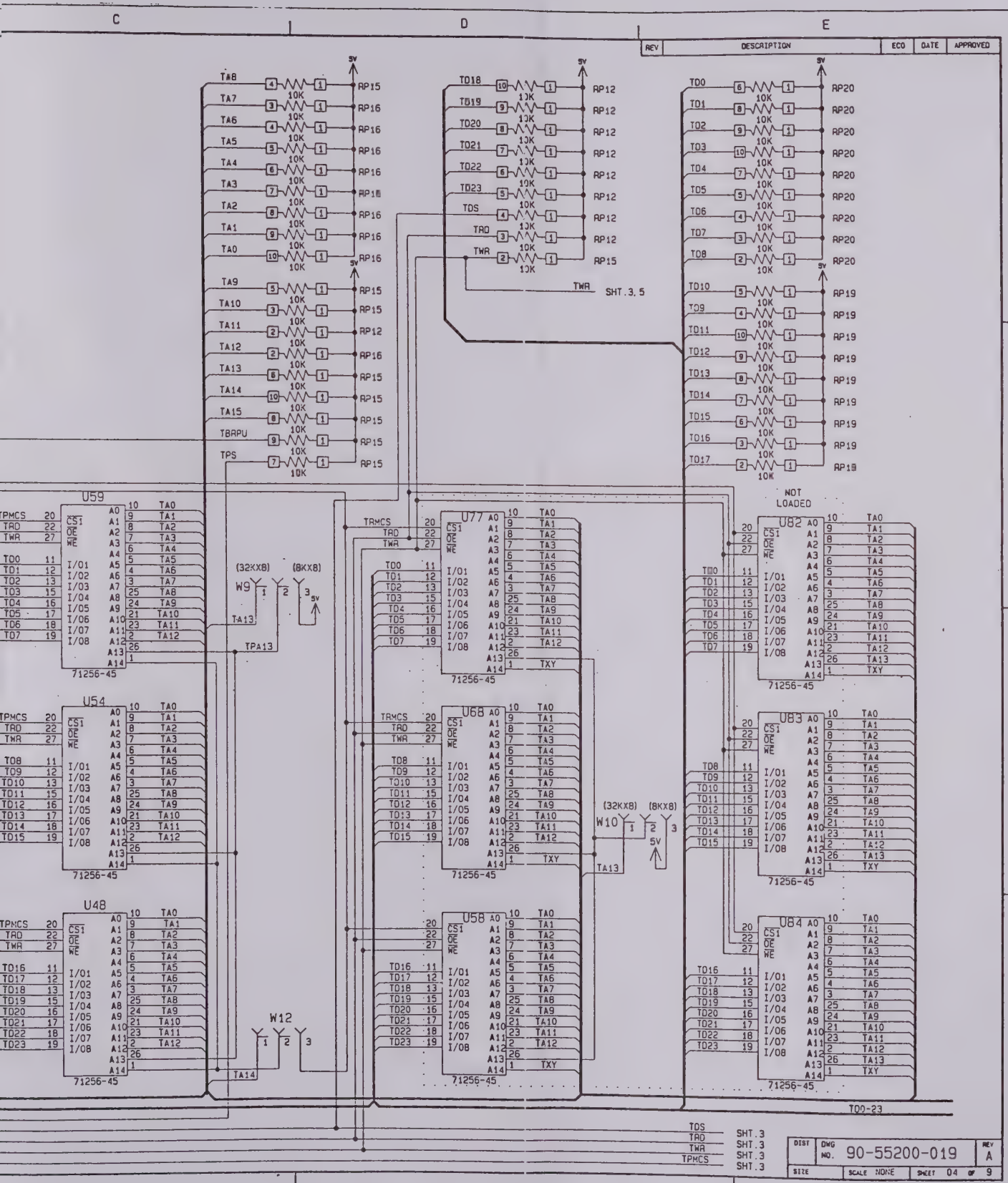

A
B
1
2
3
4
TESTPU
ALE
CNTINTA
KYBINT
CNTINT
DRQ1
DRQ0
ARDY
TMR0
RESETL
SHT.6 CNTINTA
SHT.7 KYBINT
SHT.7 CNTINT
SHT.8 DRQ1
SHT.8 DRQ0
SHT.5 ARDY
SHT.8 TMR0
SHT.5 RESETL
SCCINTA
U5
80C186
RESET
HLDA
TMROUT0
TMROUT1
CLKOUT
PCS0
PCS1
PCS2
PCS3
PCS4
PCS5/A1
PCS6/A2
LCS
UCS
MCS0
MCS1
MCS2
MCS3
ALE/QS0
WR/QS1
RD/QSMD
DEN
LOCK
DT/R
S0
S1
S2
A16/S3
A17/S4
A18/S5
A19/S6
BHE/S7
RES
HOLD
TMRIN0
TMRIN1
SRDY
ARDY
TEST
DRQ0
DRQ1
INT0
INT1
INT2/IA0
INT3/IA1
NMI
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
AD8
AD9
AD10
AD11
AD12
AD13
AD14
AD15
X1
X2
SHS.5 CLKO
SHT.6 PCS0
SHT.6 PCS1
SHT.6,8 PCS2
SHT.6,8 PCS3
SHT.6,8 PCS4
SHT.6,8 PCS5
SHT.6,8 PCS6
SHT.6 WRL
SHT.6 RDL
SHT.6 DEN
SHT.8 DTA
A16S
A17S
A18S
A19S
BHE
RESETL
DGND
TMR0
TMR1
DRQ0
DRQ1
CNTINT
KYBINT
SCCINTA
SCCINT
OPTNMEN
ARDY
TESTPU
C2
33PF
Y1
20mhz
C1
22PF
L1
20uH
NOT LOADED
220pf
C3
5V
RP1
10K
SHT.6 SCCPU
TMR0
TMR1
WRL
SHT.6 SCCRQB
SHT.6 SCCRQA
SHT.6 SCCINT
U9
U8
U1
U13
U12
74ACT573
74ACT245
DIR
G
DEN
DTA
SHT.2 RHEN
SHT.3 XHEN
SHT.2 RHACK
SHT.3 XHACK
SHT.2 RINTA
SHT.3 XINTA
SHT.2 RINTB
SHT.3 XINTB
SHT.2 RD23
SHT.3 TD23
U49
750PAL
SHT.7 POLCS
SHT.5 PSALLD
SHT.5 FFHFUL
SHT.5 FFEMPTY
SHT.7 PAGE2
SHT.7 PAGE1
CA0-CA15
U15
173PLD
CA19
CA18
CA17
CA16
CA15
CA14
CA13
CA0
BHEL
S2L
PAGE1
PAGE2

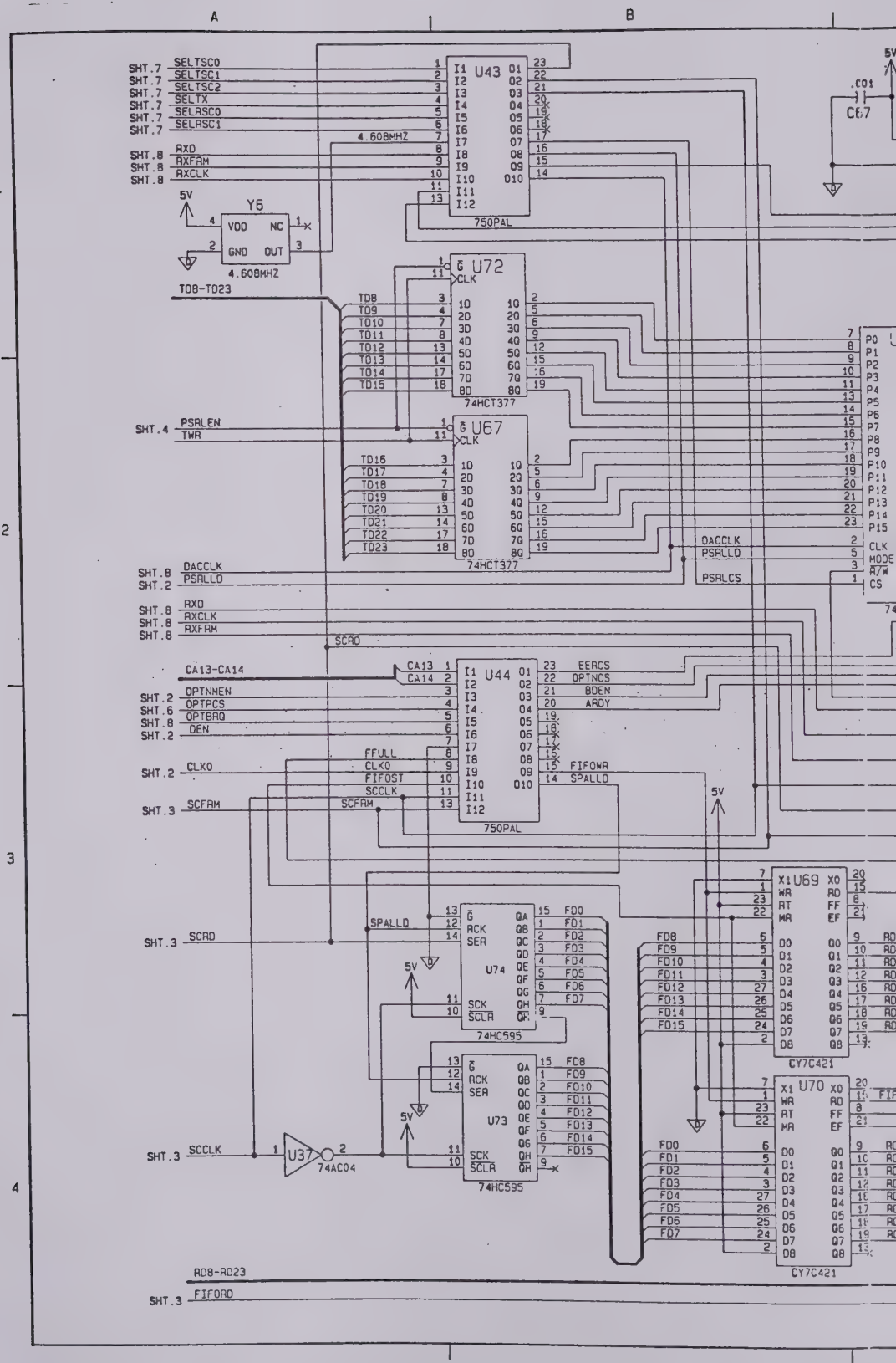

C
D
E
REV
DESCRIPTION
ECO
DATE
APPROVED
(FLASH)
W2
5V
W3
WRL
(1MEG)
(4MEG)
CA19
(RAM)
W1
(ROM)
CA15
RDL
(8MEG)
(1MEG)
W6
PAGE2
SCCINTA
SHT.6
U7
U11
U17
U23
U6
U10
U16
U22
27010
1245A8 /1235A8
62256
AM1HCS
U25
74AC04
RWAL
SHT3, 4
(2MEG)
(512K)
W4
W5
CA18
CD0-CD15
OPTNMEN
SHT.5
AM2LCS
AM2HCS
AM1LCS
AM1HCS
EP1HCS
EP1LCS
EP2LCS
EP2HCS
DIST
DWG NO. 90-55200-019
REV A
SIZE
SCALE NONE
SHEET 02 OF 9

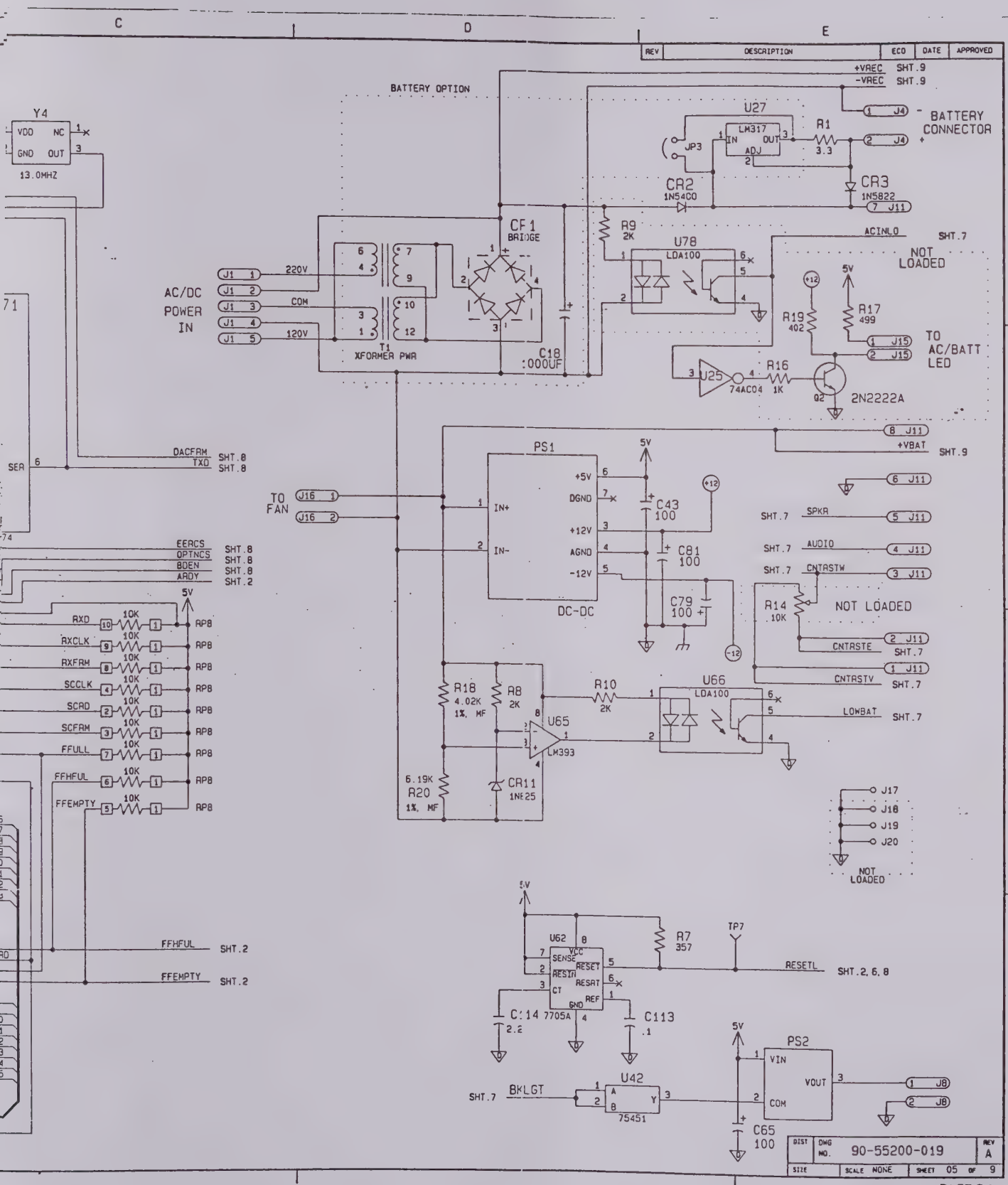

A
B
1
2
3
4
5V
RD0
RD1
RD2
RD3
RD4
RD5
RD6
RD7
RD8
RD9
RD10
RD11
RD12
RD13
RD14
RD15
RD16
RD17
RD18
RD19
RD20
RD21
RD22
RD23
RA0
RA1
RA2
RA3
RA4
RA5
RA6
RA7
RA8
RA9
RA10
RA11
RA12
RA13
RA14
RA15
RBRPU
RPS
AWR
ARD
RAM
RP13
RP17
RP18
RP21
RP22
10K
ROPTMEM
U79
U80
U81
U76
U57
U56
U61
U60
U52
RAMCS
ARD
AWR
RXY
71256-45
RD8-RD23
NOT
LOADED
RA0-RA15
(8KX8)
(32KX8)
W8
W7

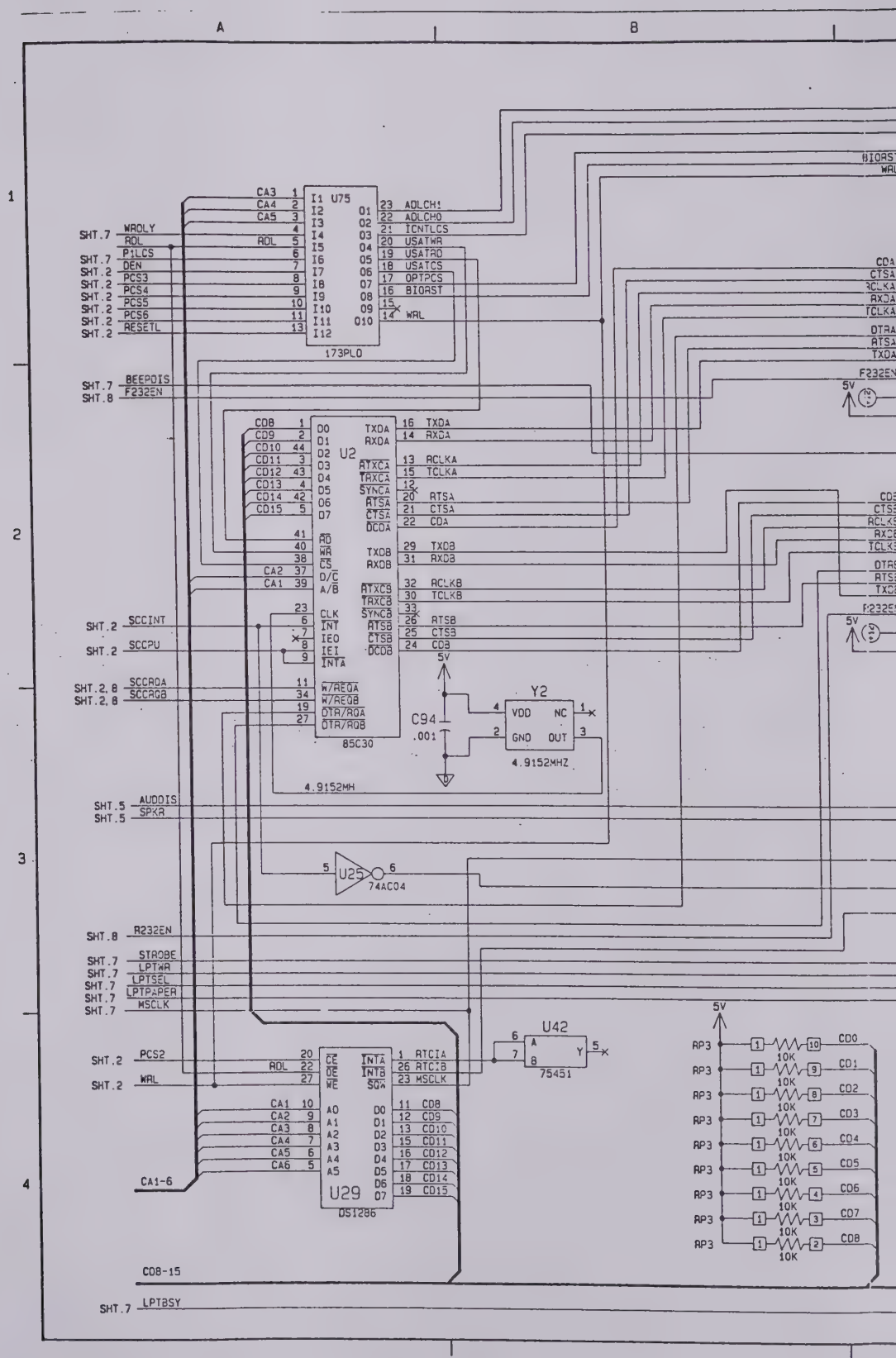

C
D
E
REV
DESCRIPTION
ECO
DATE
APPROVED
5V
Y5
C73
.001
VDD
NC
GND
OUT
20.48MHZ
SHT.5 SCFRM
SHT.5 SCCLK
SHT.5 SCRD
SHT 2 RRST
SHT 2 RINTA
SHT 2 RINTB
EXTAL SHT.4
RSTXD SHT.8
SCICLK SHT.4
SCITXD SHT.4
88 SHT.4
U51
56001
VCC6
VCC5
SRD
STD
SCK
SC0
SC1
SC2
GND9
GND10
EXTAL
XTAL
SCLK
TXD
RXD
RESET
MODA/IRQA
NMI/MODB/IRQB
RRST
RINTA
RINTB
ABAPU
CA1-CA3
RWRL SHT.2
RHEN SHT.2
RHACK SHT.2
RHREQ SHT.7.8
CD0-CD7
VCC1
VCC2
VCC3
VCC4
VCC7
VCC8
VCC9
VCC10
GND1
GND2
GND3
GND4
GND11
GND12
GND13
GND14
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
D23
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
HA0
HA1
HA2
HR/W
HEN
HACK
HREQ
H0
H1
H2
H3
H4
H5
H6
H7
CA1
CA2
CA3
CD0
CD1
CD2
CD3
CD4
CD5
CD6
CD7
RDS
RWR
RRD
RXY
RA13
RA14
W11
W13
W14
U55
750PAL/18CV8
RA15
APS
RDS
RWR
RRD
TWR
TDS
TPS
ARMCS
FIFOST
FIFORD
APMCS
TAMCS
PSALEN
TPMCS
ROPTMEM
TA15
TOPTMEM
TA13
TA14
SHT.5
SHT.4
SHT.7
DIST
DWG NO. 90-55200-019
REV A
SIZE
SCALE NONE
SHEET 03 OF 9

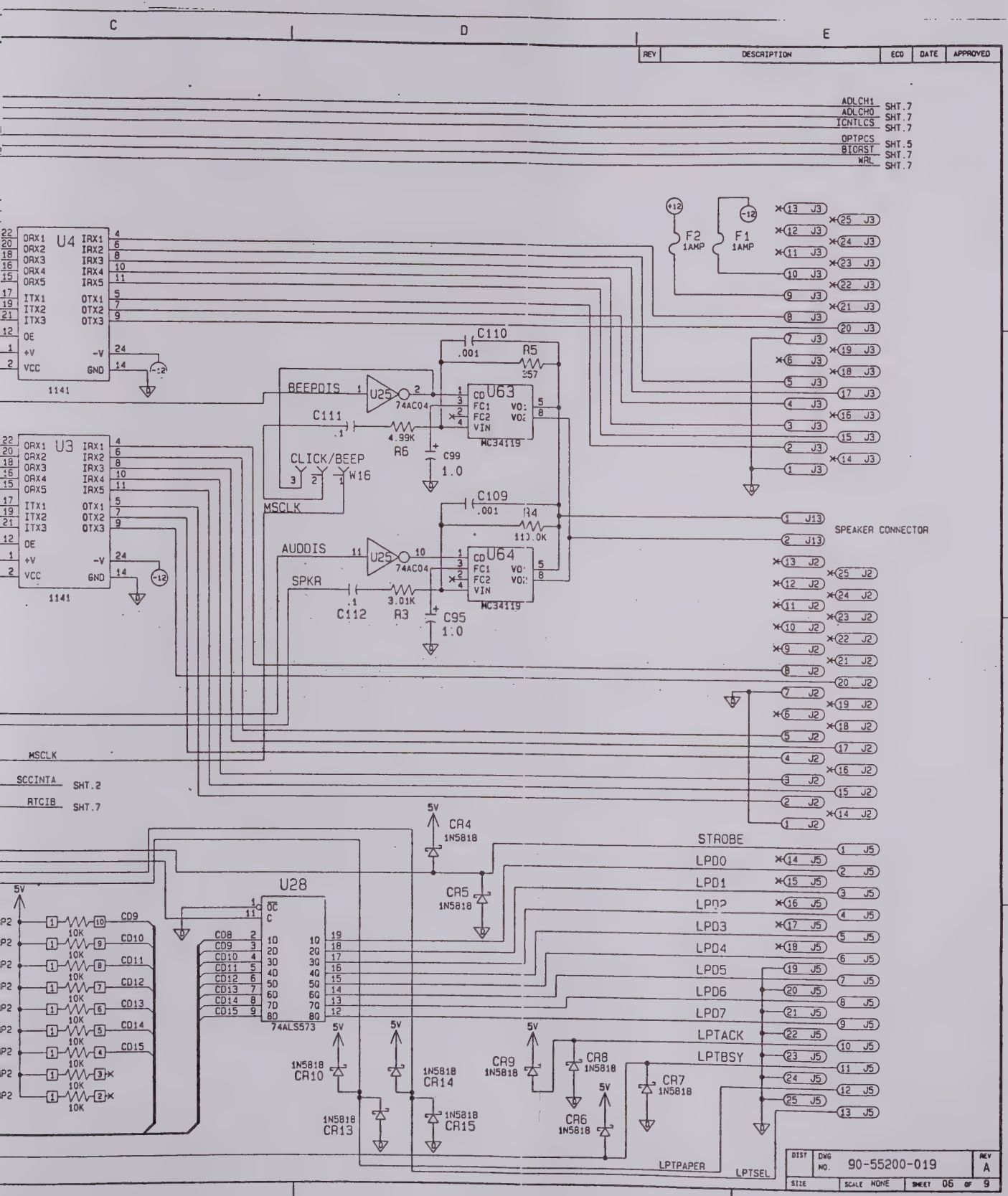

A
B
1
2
3
4
SHT.7 SELTDSP
SELTDSP
U38
TSTXD
74BCT125
SHT.7 SELADSP
SELADSP
U38
SHT.3 ASTXD
74BCT125
SHT.3 TOPTMEM
SHT.3 TRMCS
SHT.3
SHT.3 SCRD
SCRD
SHT.5 SCCLK
SHT.5 SCFRM
SHT.3 EXTAL
SHT.3 SCICLK
SHT.3 BB
SHT.3 SCIRXD
5V
TBRPU
SHT.7 XRST
SHT.2 XINTA
SHT.2 XINTB
RESET
MODA/IRQA
NMI/MODB/IRQB
CA0-3
CA3
CA2
CA1
SHT.2 RWRL
SHT.2 XHEN
SHT.2 XHACK
SHT.7,8 XHREQ
HA2
HA1
HA0
HR/W
HEN
HACK
HREQ
GND13
GND14
VCC7
VCC8
H7
H6
H5
H4
H3
H2
H1
H0
GND11
GND12
CD7
CD6
CD5
CD4
CD3
CD2
CD1
CD0
CD0-7
U47
56001
RXD
TXD
SCLK
XTAL
EXTAL
GND10
GND9
SC2
SC1
SC0
SCK
STD
SRD
VCC5
VCC6
VCC2
VCC1
D23
D22
D21
D20
D19
D18
D17
D16
D15
D14
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
D0
GND1
GND2
GND3
GND4
TXY
TWR
IRQ
TOS
TPS
GND8
GND7
GND6
GND5
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
VCC3
VCC4
TA0
TA1
TA2
TA3
TA4
TA5
TA6
TA7
TA8
TA9
TA10
TA11
TA12
TA13
TA14
TA15
TA0-15

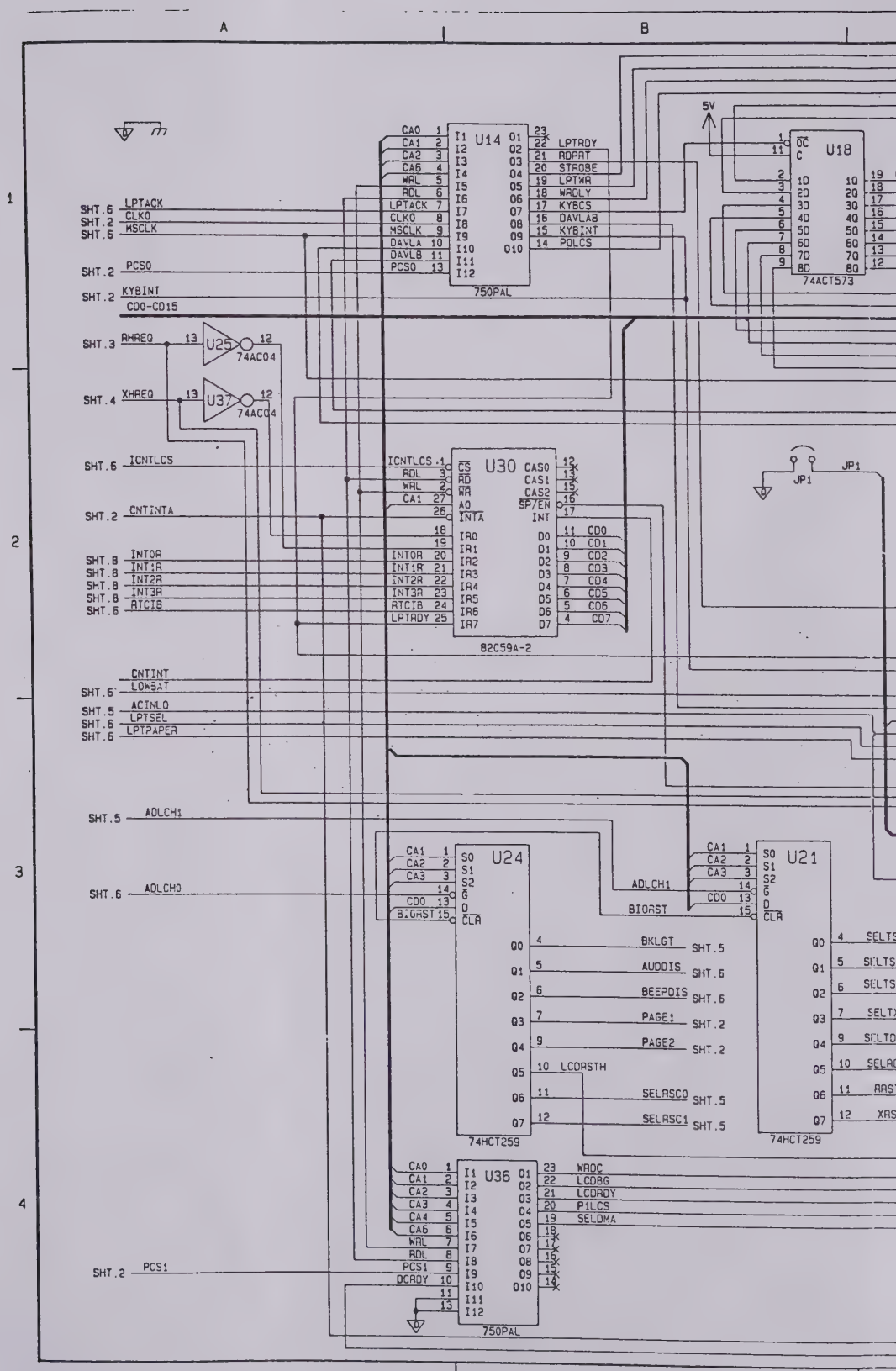

C
D
E
REV
DESCRIPTION
ECO
DATE
APPROVED
5V
10K
RP15
RP16
RP12
RP20
RP19
TA8
TA7
TA6
TA5
TA4
TA3
TA2
TA1
TA0
TA9
TA10
TA11
TA12
TA13
TA14
TBRPU
TPS
TD18
TD19
TD20
TD21
TD22
TD23
TDS
TRD
TWR
SHT. 3, 5
TD0
TD1
TD2
TD3
TD4
TD5
TD6
TD7
TD8
TD9
TD10
TD11
TD12
TD13
TD14
TD15
TD16
TD17
TD18
TD19
TD20
TD21
TD22
TD23
TD0-23
NOT LOADED
U59
U54
U48
U77
U68
U58
U82
U83
U84
71256-45
TPMCS
TRD
TWR
TRMCS
TXY
W9
W10
W12
(32KX8)
(8KX8)
SHT. 3
SHT. 3
SHT. 3
SHT. 3
DIST
DWG NO. 90-55200-019
REV A
SIZE
SCALE NONE
SHEET 04 OF 9

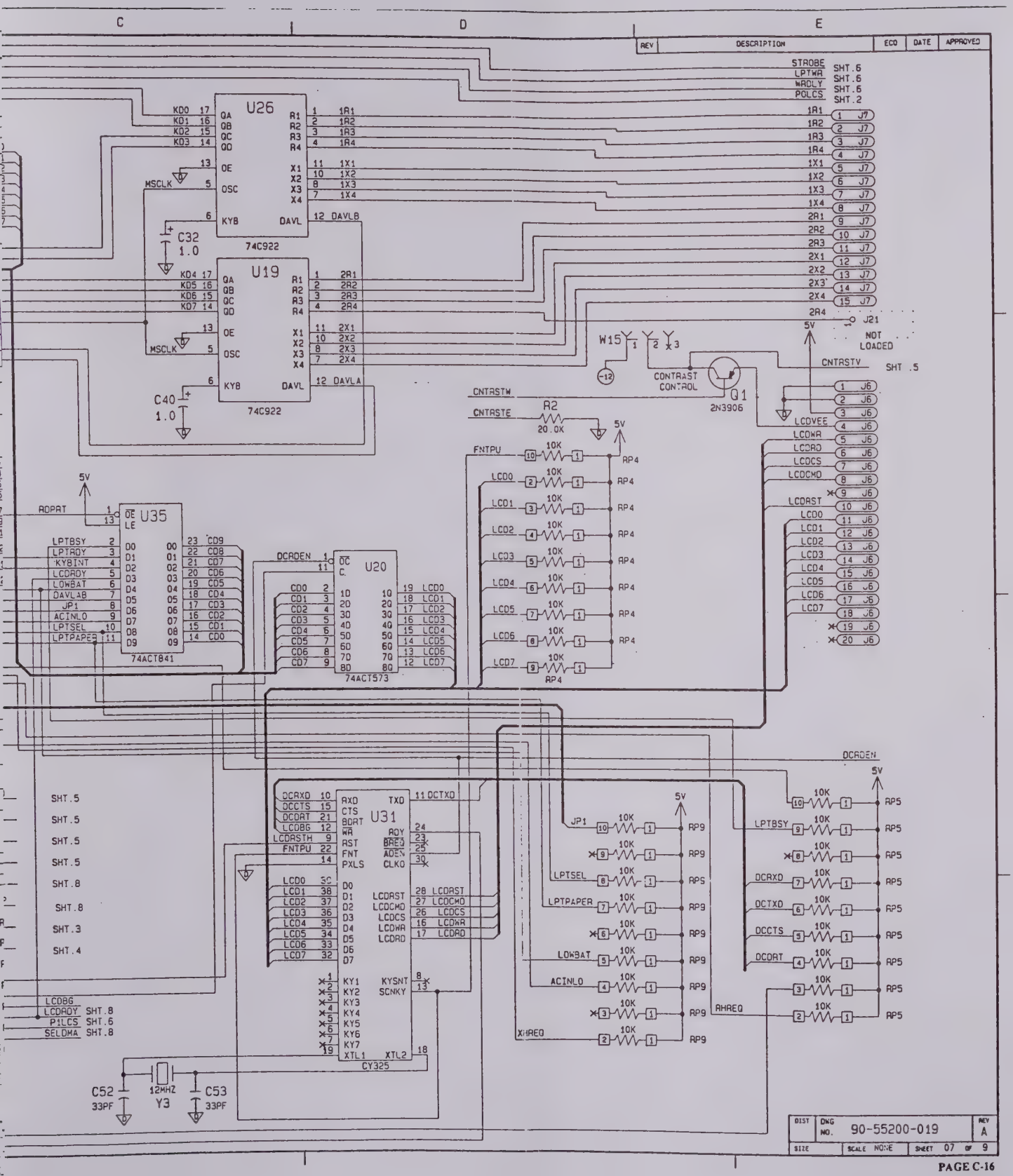

A
B
1
2
3
4
SHT.7 SELTSC0
SHT.7 SELTSC1
SHT.7 SELTSC2
SHT.7 SELTX
SHT.7 SELASC0
SHT.7 SELASC1
SHT.8 RXD
SHT.8 RXFAM
SHT.8 RXCLK
4.608MHZ
U43
750PAL
Y6
VDD
NC
GND
OUT
4.608MHZ
5V
.001
C67
TD8-TD23
U72
74HCT377
SHT.4 PSALEN
TWR
U67
74HCT377
SHT.8 DACCLK
SHT.2 PSALLD
DACCLK
PSALLD
PSALCS
SHT.8 RXD
SHT.8 RXCLK
SHT.8 RXFAM
SCRD
CA13-CA14
U44
750PAL
SHT.2 OPTNMEN
SHT.6 OPTPCS
SHT.8 OPTBRQ
SHT.2 DEN
EERCS
OPTNCS
BOEN
ARDY
SHT.2 CLKO
FFULL
CLKO
FIFOST
SCCLK
FIFOWR
SPALLD
SHT.3 SCFRM
SCFRM
SHT.3 SCRD
SPALLD
U74
74HC595
U73
74HC595
SHT.3 SCCLK
U37
74AC04
U69
CY7C421
U70
CY7C421
FD0
FD1
FD2
FD3
FD4
FD5
FD6
FD7
FD8
FD9
FD10
FD11
FD12
FD13
FD14
FD15
AD8-AD23
SHT.3 FIFOAD

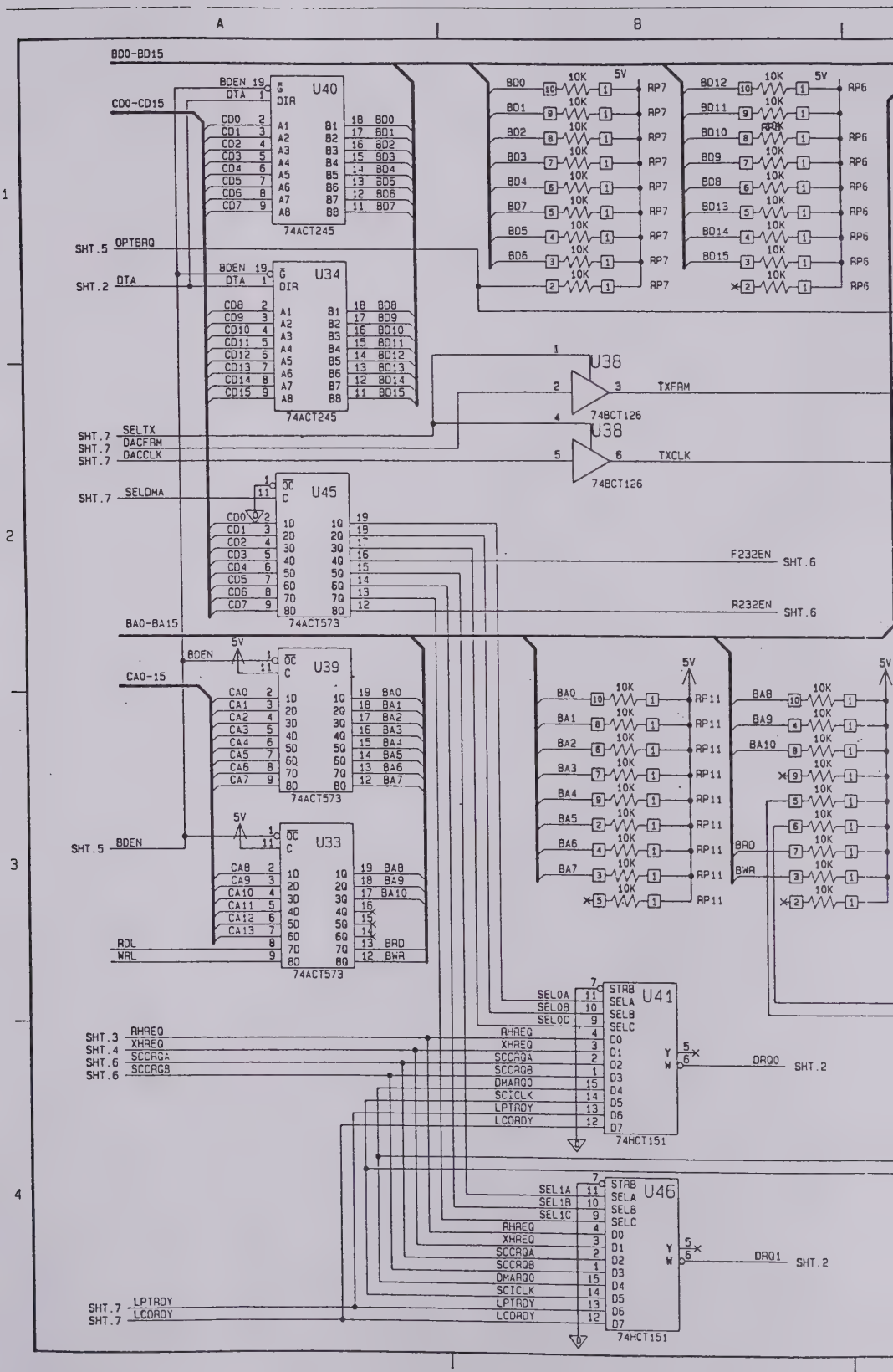

REV
DESCRIPTION
ECO
DATE
APPROVED
BATTERY OPTION
+VREC SHT.9
-VREC SHT.9
BATTERY CONNECTOR
U27
LM317
JP3
R1
3.3
CR2
1N5400
CR3
1N5822
CF1
BRIDGE
R9
2K
U78
LDA100
ACINLO SHT.7
NOT LOADED
R19
402
R17
499
TO AC/BATT LED
U25
74AC04
R16
1K
Q2
2N2222A
AC/DC POWER IN
220V
COM
120V
T1
XFORMER PWR
C18
.000UF
+VBAT SHT.9
PS1
DC-DC
+5V
DGND
+12V
AGND
-12V
IN+
IN-
C43
100
C81
100
C79
100
TO FAN
SPKR SHT.7
AUDIO SHT.7
CNTRSTW SHT.7
R14
10K
NOT LOADED
CNTRSTE SHT.7
CNTRSTV SHT.7
LOWBAT SHT.7
R18
4.02K
1%, MF
R8
2K
R10
2K
U66
LDA100
U65
LM393
R20
6.19K
1%, MF
CR11
1NE25
DACFRM SHT.8
TXD SHT.8
EERCS SHT.8
OPTNCS SHT.8
BOEN SHT.8
ARDY SHT.2
RXD
RXCLK
RXFRM
SCCLK
SCRD
SCFRM
FFULL
FFHFUL
FFEMPTY
10K
RP8
FFHFUL SHT.2
FFEMPTY SHT.2
U62
7705A
R7
357
TP7
RESETL SHT.2, 6, 8
C114
2.2
C113
.1
U42
75451
BKLGT SHT.7
PS2
VIN
VOUT
COM
C65
100
J17
J18
J19
J20
NOT LOADED
DIST
DWG NO. 90-55200-019
REV A
SIZE
SCALE NONE
SHEET 05 OF 9

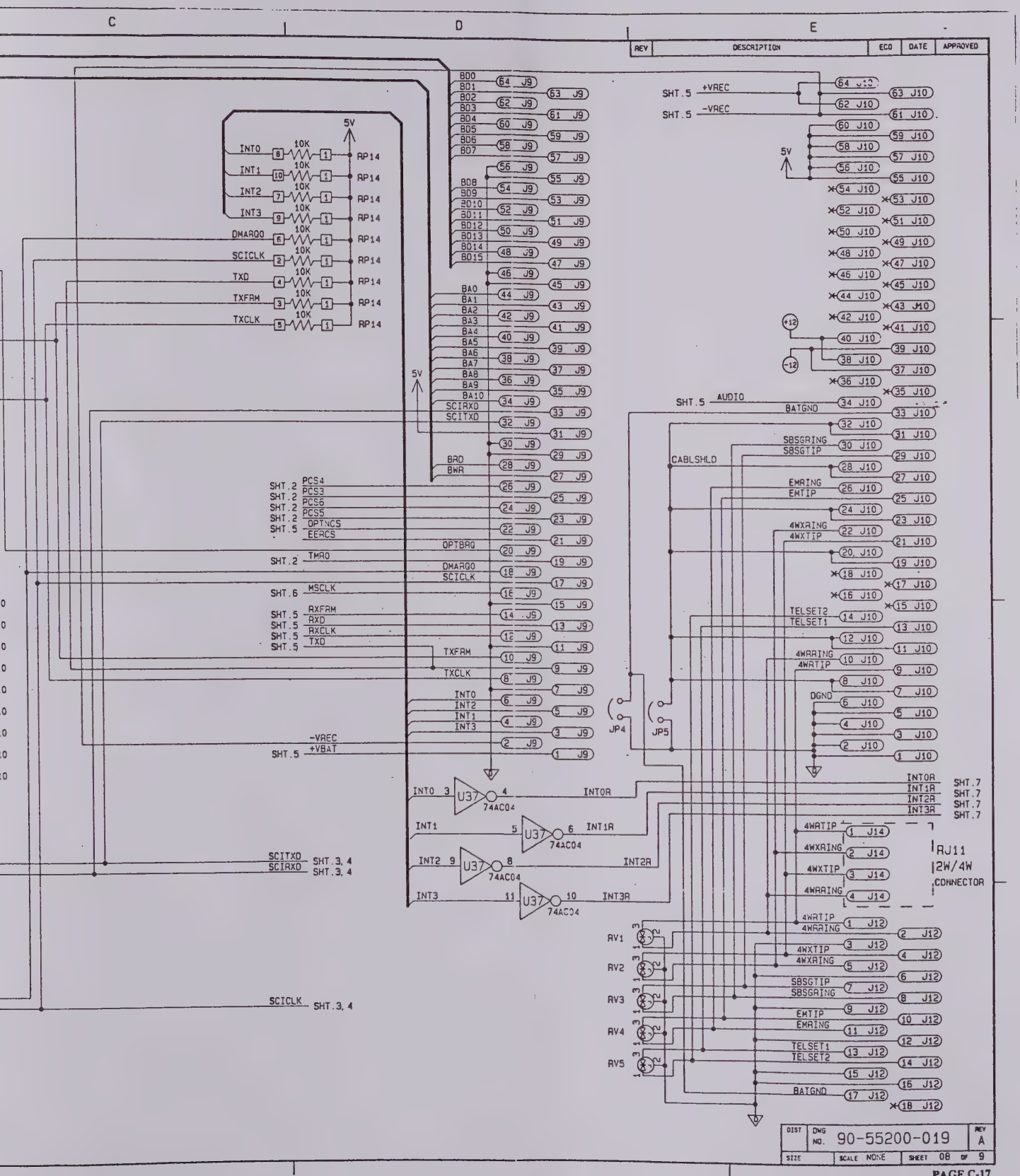

A
B
1
2
3
4
U75
173PLD
U2
85C30
Y2
4.9152MHZ
U25
74AC04
U42
75451
U29
DS1286
RP3
10K
5V
SHT.7 WRDLY
SHT.7 DEN
SHT.2 PCS3
SHT.2 PCS4
SHT.2 PCS5
SHT.2 PCS6
SHT.2 RESETL
SHT.7 BEEPDIS
SHT.8 F232EN
SHT.2 SCCINT
SHT.2 SCCPU
SHT.2,8 SCCAOA
SHT.2,8 SCCAOB
SHT.5 AUDDIS
SHT.5 SPKR
SHT.8 R232EN
SHT.7 STROBE
SHT.7 LPTWR
SHT.7 LPTSEL
SHT.7 LPTPAPER
SHT.7 MSCLK
SHT.2 PCS2
SHT.2 WRL
CA1-6
CD8-15
SHT.7 LPTBSY
4.9152MH
C94
.001

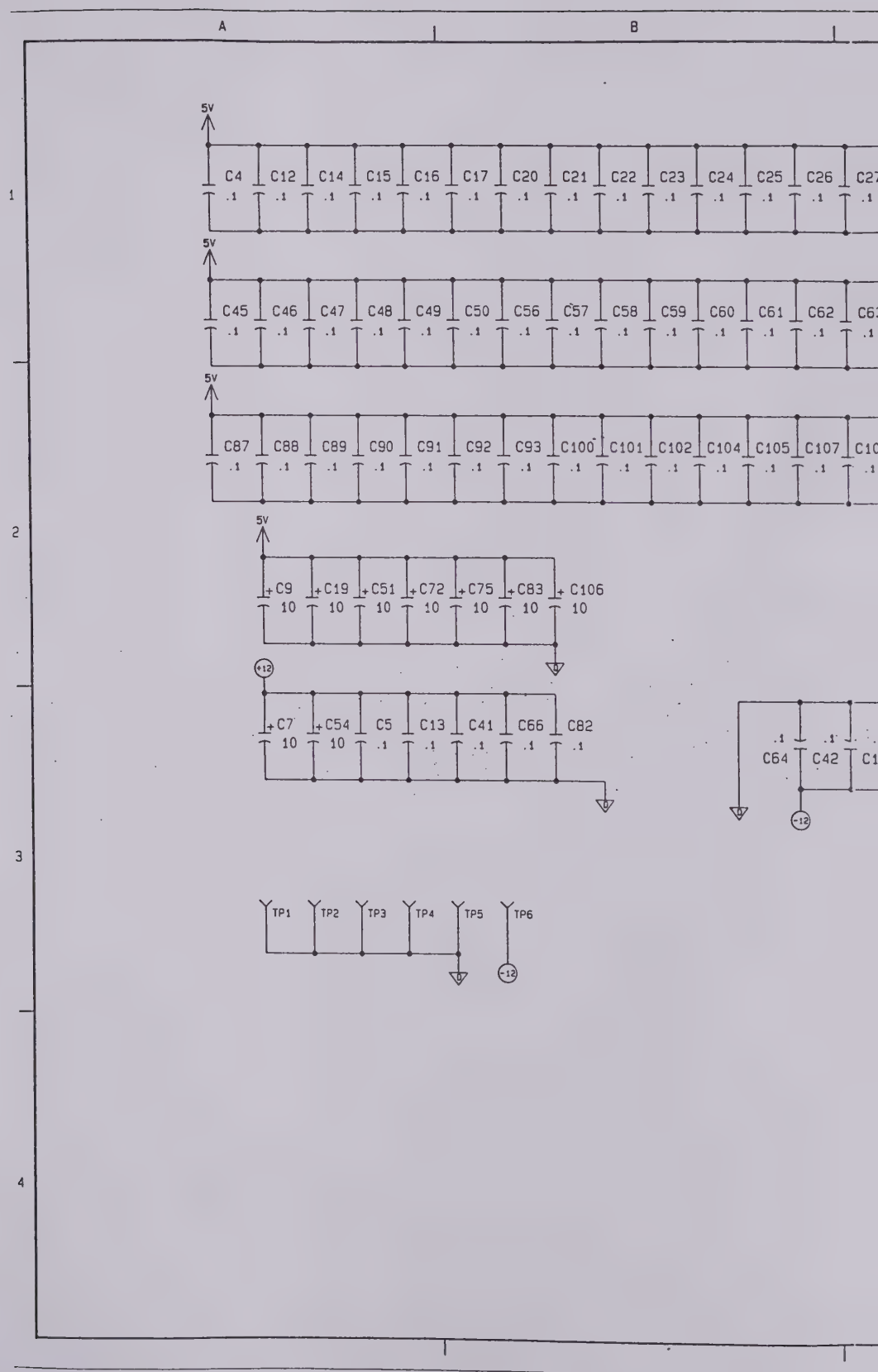

C
D
E
REV
DESCRIPTION
ECO
DATE
APPROVED
ADLCH1 SHT.7
ADLCH0 SHT.7
ICNTLCS SHT.7
OPTPCS SHT.5
BIORST SHT.7
WRL SHT.7
U4
U3
1141
F2 1AMP
F1 1AMP
C110 .001
R5 257
C111 .1
R6 4.99K
C99 1.0
C109 .001
R4 110.0K
C112 .1
R3 3.01K
C95 1.0
BEEPDIS
CLICK/BEEP
W16
MSCLK
AUDDIS
SPKR
U25 74AC04
U63 MC34119
U64 MC34119
SPEAKER CONNECTOR
SCCINTA SHT.2
RTCIB SHT.7
U28 74ALS573
CR4 1N5818
CR5 1N5818
CR6 1N5818
CR7 1N5818
CR8 1N5818
CR9 1N5818
CR10 1N5818
CR13 1N5818
CR14 1N5818
CR15 1N5818
STROBE
LPD0
LPD1
LPD2
LPD3
LPD4
LPD5
LPD6
LPD7
LPTACK
LPTBSY
LPTPAPER
LPTSEL
CD8
CD9
CD10
CD11
CD12
CD13
CD14
CD15
10K
DIST
DWG NO. 90-55200-019
REV A
SIZE
SCALE NONE
SHEET 06 OF 9


A
B
1
2
3
4
U14
750PAL
U18
74ACT573
U25
74AC04
U37
74AC04
U30
82C59A-2
U24
74HCT259
U21
74HCT259
U36
750PAL
JP1
5V
LPTACK
CLKO
MSCLK
PCSO
KYBINT
CDO-CD15
AHREQ
XHREQ
ICNTLCS
CNTINTA
INTOR
INT1R
INT2R
INT3R
RTCIB
CNTINT
LOWBAT
ACINLO
LPTSEL
LPTPAPER
ADLCH1
ADLCH0
PCS1
LPTRDY
RDPRT
STROBE
LPTWR
WRDLY
KYBCS
DAVLAB
KYBINT
POLCS
BKLGT
AUDDIS
BEEPDIS
PAGE1
PAGE2
LCDRSTH
SELRSC0
SELRSC1
BIORST
WRDC
LCDBG
LCDRDY
P1LCS
SELDMA

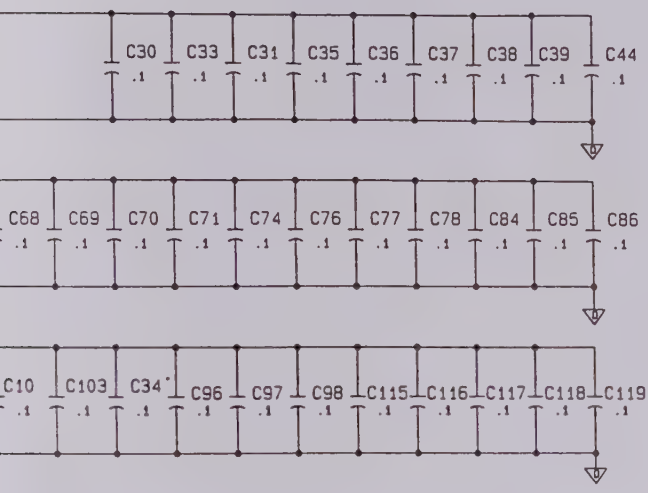

C
D
E
REV
DESCRIPTION
ECO
DATE
APPROVED
U26
74C922
U19
74C922
C32
1.0
C40
1.0
MSCLK
KYB
DAVL
DAVLB
DAVLA
STROBE
LPTWR
WRDLY
POLCS
SHT.6
SHT.2
J7
J21
NOT LOADED
W15
CONTRAST CONTROL
Q1
2N3906
CNTRSTV
SHT .5
CNTRSTW
CNTRSTE
R2
20.0K
5V
FNTPU
10K
RP4
LCD0
LCD1
LCD2
LCD3
LCD4
LCD5
LCD6
LCD7
LCDVEE
LCDWR
LCDRD
LCDCS
LCDCMD
LCDRST
J6
ADPRT
U35
74ACT841
LPTBSY
LPTRDY
KYBINT
LCDRDY
LOWBAT
DAVLAB
JP1
ACINLO
LPTSEL
LPTPAPER
DCRDEN
U20
74ACT573
SHT.5
SHT.8
SHT.3
SHT.4
U31
CY325
DCRXD
DCCTS
DCDRT
LCDBG
FNTPU
LCDRSTH
PXLS
DCTXD
KY1
KY2
KY3
KY4
KY5
KY6
KY7
KYSNT
SCNKY
XTL1
XTL2
C52
33PF
12MHZ
Y3
C53
33PF
RP5
AHREQ
XHREQ
DIST
DWG NO.
90-55200-019
REV A
SIZE
SCALE NONE
SHEET 07 OF 9

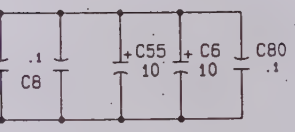

A
B
BD0-BD15
CD0-CD15
BDEN
DTA
U40
74ACT245
SHT.5 OPTBRQ
SHT.2 DTA
U34
74ACT245
BD0 BD1 BD2 BD3 BD4 BD7 BD5 BD6
BD12 BD11 BD10 BD9 BD8 BD13 BD14 BD15
10K 5V RP7 RP6
U38
74BCT126
TXFRM
TXCLK
SHT.7 SELTX
SHT.7 DACFRM
SHT.7 DACCLK
SHT.7 SELDMA
U45
74ACT573
F232EN SHT.6
R232EN SHT.6
BA0-BA15
CA0-15
U39
74ACT573
SHT.5 BDEN
U33
74ACT573
RDL
WRL
BA0 BA1 BA2 BA3 BA4 BA5 BA6 BA7
BA8 BA9 BA10 BAD BAR
RP11
SHT.3 AHREQ
SHT.4 XHREQ
SHT.6 SCCRQA
SHT.6 SCCRQB
U41
74HCT151
DRQ0 SHT.2
SEL0A SEL0B SEL0C
AHREQ XHREQ SCCRQA SCCRQB DMARQ0 SCICLK LPTRDY LCDRDY
STRB SELA SELB SELC D0 D1 D2 D3 D4 D5 D6 D7 Y W
U46
74HCT151
DRQ1 SHT.2
SEL1A SEL1B SEL1C
SHT.7 LPTRDY
SHT.7 LCDRDY


C
D
E
REV
DESCRIPTION
ECO
DATE
APPROVED
5V
INT0
INT1
INT2
INT3
DMARQ0
SCICLK
TXD
TXFRM
TXCLK
10K
RP14
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
BD8
BD9
BD10
BD11
BD12
BD13
BD14
BD15
BA0
BA1
BA2
BA3
BA4
BA5
BA6
BA7
BA8
BA9
BA10
SCIRXD
SCITXD
BRD
BWR
SHT.2 PCS4
SHT.2 PCS3
SHT.2 PCS6
SHT.2 PCS5
SHT.5 OPTNCS
EERCS
OPTBRQ
SHT.2 TMR0
DMARQ0
SCICLK
SHT.6 MSCLK
SHT.5 RXFRM
SHT.5 RXD
SHT.5 RXCLK
SHT.5 TXD
TXFRM
TXCLK
INT0
INT2
INT1
INT3
-VREC
SHT.5 +VBAT
SCITXD SHT.3, 4
SCIRXD SHT.3, 4
SCICLK SHT.3, 4
U37
74AC04
INT0R
INT1R
INT2R
INT3R
JP4
JP5
SHT.5 +VREC
SHT.5 -VREC
+12
-12
SHT.5 AUDIO
BATGND
SBSGRING
SBSGTIP
CABLSHLD
EMRING
EMTIP
4WXRING
4WXTIP
TELSET2
TELSET1
4WRRING
4WRTIP
DGND
INT0R SHT.7
INT1R SHT.7
INT2R SHT.7
INT3R SHT.7
RJ11
2W/4W
CONNECTOR
RV1
RV2
RV3
RV4
RV5
DIST
DWG NO. 90-55200-019
REV A
SIZE
SCALE NONE
SHEET 08 OF 9

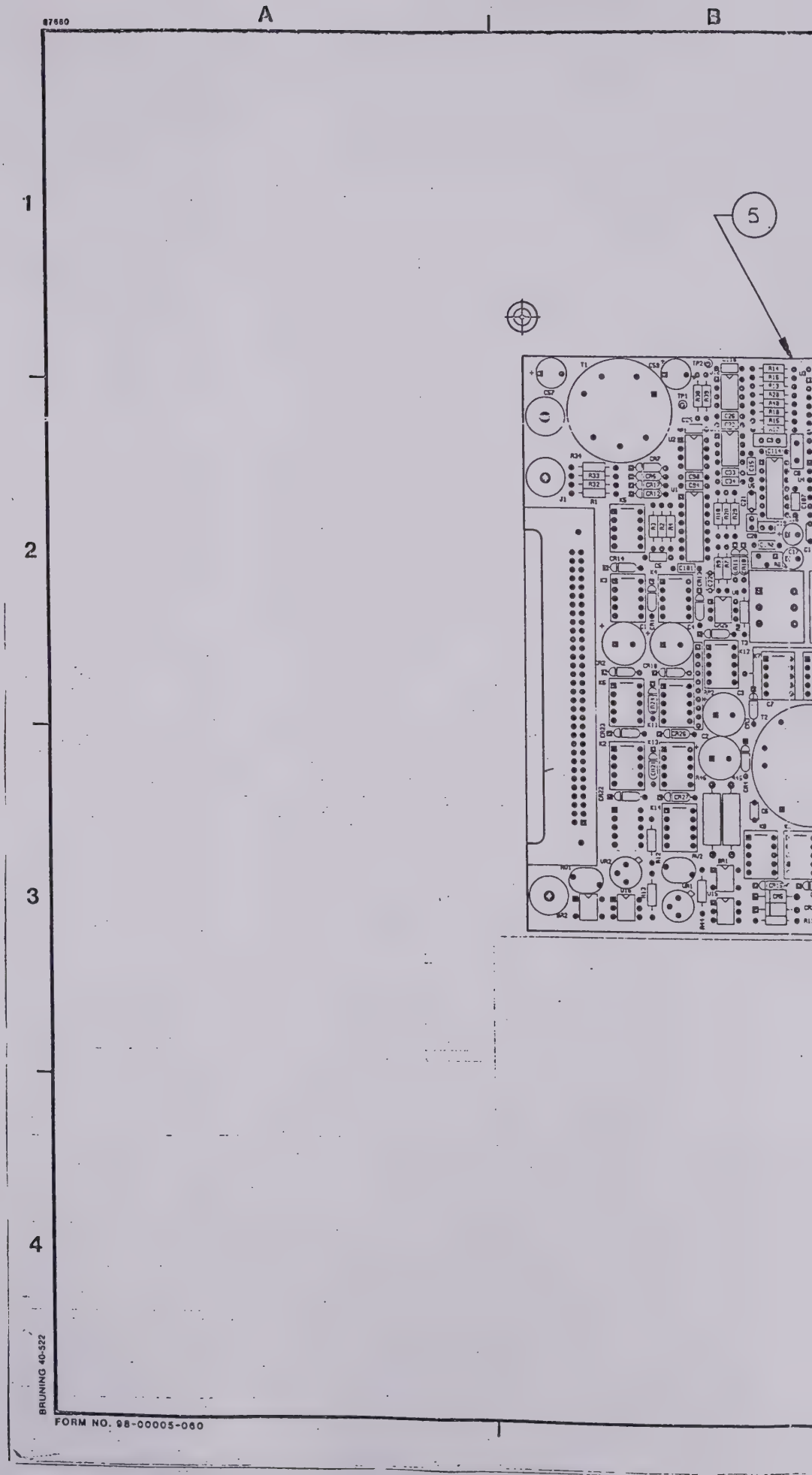

A
B
1
2
3
4
5V
C4 C12 C14 C15 C16 C17 C20 C21 C22 C23 C24 C25 C26
.1
5V
C45 C46 C47 C48 C49 C50 C56 C57 C58 C59 C60 C61 C62
.1
5V
C87 C88 C89 C90 C91 C92 C93 C100 C101 C102 C104 C105 C107
.1
5V
C9 C19 C51 C72 C75 C83 C106
10
+12
C7 C54 C5 C13 C41 C66 C82
10 10 .1 .1 .1 .1 .1
C64 C42
.1
-12
TP1 TP2 TP3 TP4 TP5 TP6
-12

REV	DESCRIPTION	ECO	DATE	APPROVED

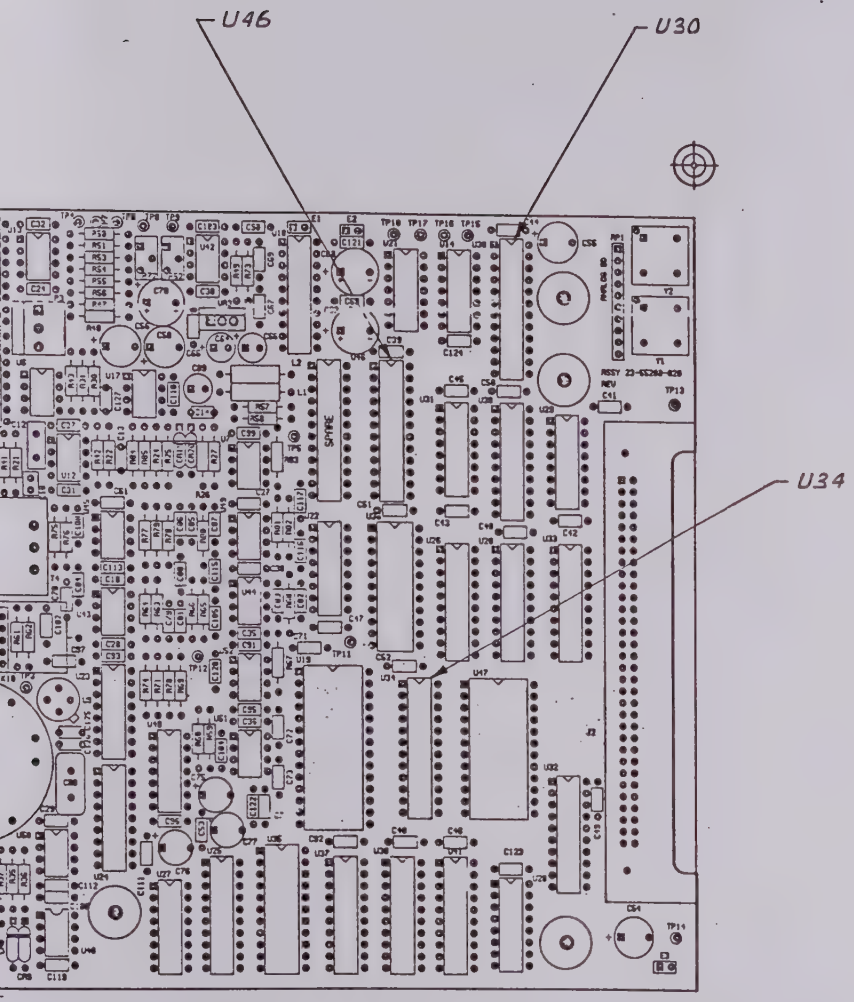




DIST	DWG NO. 90-55200-019	REV A
SIZE	SCALE NONE	SHEET 09 OF 9


97680
A
B
1
2
3
4
5
BRUNING 40-522
FORM NO. 98-00005-060

REV	DESCRIPTION	DATE	ECO	APPROVED
B	DRAWING RELEASE ON DRN# 5200		3/23/93	



SILKSCREEN

SEE SEPARATE B/M 23-55200-021

QTY -020	QTY -010	ITEM	PART NUMBER	DESCRIPTION	VENDOR OR APPROVED EQUIVALENT	VENDOR PART NO.	REF DESIG.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

TOLERANCES:
DECIMALS (.XX) ± FRACTIONS ±
DECIMALS (.XXX) ± ANGLES ±

NEXT ASSY	PRODUCT

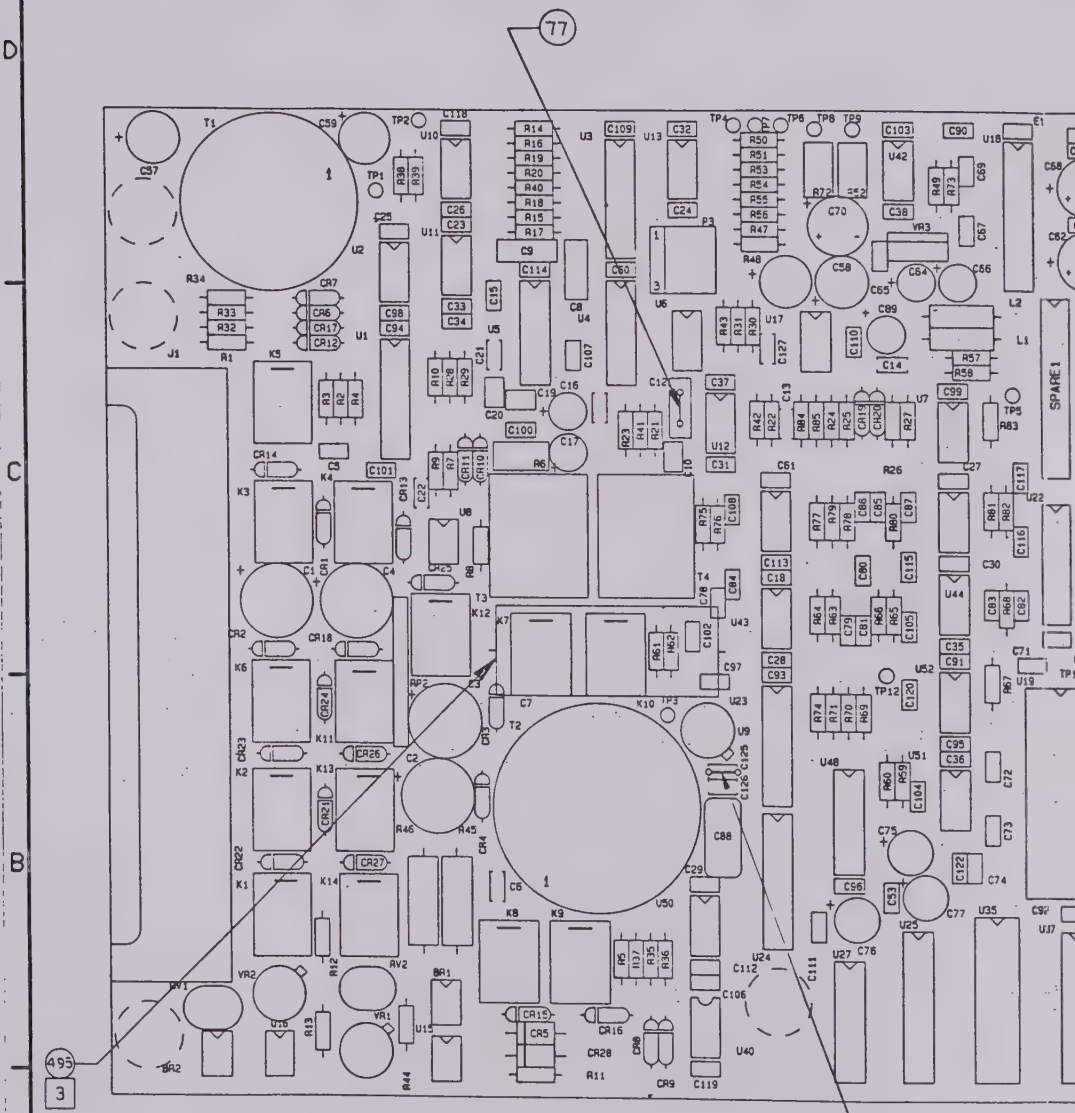
DRAWN ech 11-12-92
CHECKED 11/13/92
ENGINEER 3/23/93
MANAGER 3/23/93
MFG
QA
SERVICE
RELEASED

QXR Telcom SAN JOSE, CA. 95131

TESTED PC ASSEMBLY, ANALOG BOARD, 5200

DIST. CODE | DWG NO. 23-55200-021 | REV B

SIZE C | SCALE ~ | SHEET 1 OF 1



7. LOAD VR1 AND VR2 PER DETAIL "B" TO PREVENT HS1 AND HS2 FROM COLLIDING. USE SILICONE COMPOUND (G.E.G641 OR EQUIV.) WHEN INSTALLING HS1 AND HS2.
6. LOAD ITEM 76 (8PL) WHERE SILKSCREEN INDICATES CR13-16, 21-24. LOAD ITEM 78 WHERE SILKSCREEN INDICATES R11,12.
5. DO NOT SUBJECT T1-4 TO CLEANING SOLUTIONS.
4. DO NOT LOAD THE FOLLOWING PARTS: E1; C10,12,125,126; P3; R21.

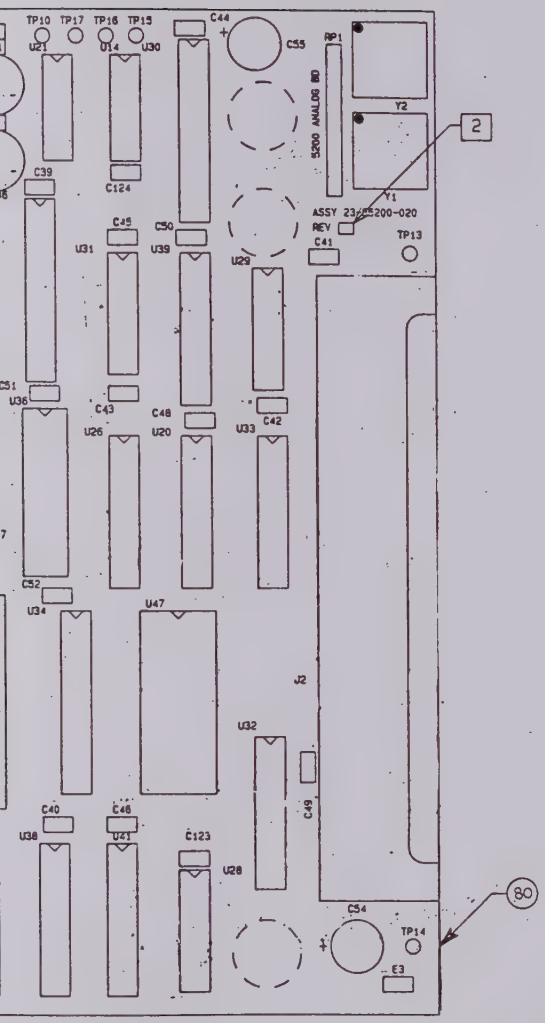
[3] SEE DETAIL "A" FOR MOUNTING.

[2] STAMP LATEST REV. LEVEL WHERE SHOWN. ON SOLDER SIDE

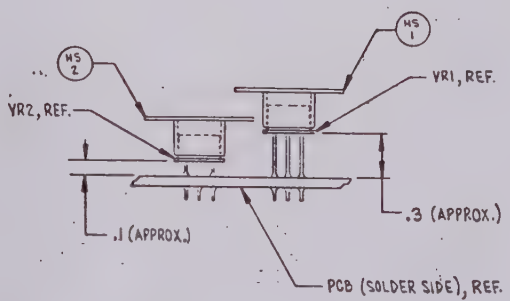
1. REF DWGS:
SCHEMATIC : 90-55200-020

NOTES: (UNLESS OTHERWISE SPECIFIED)

REV		ECO	DATE	APPROVED
A	RELEASE PER DRN# 5200	—	5/2/90	M.E.SEELEY
A1	REVISED PER ECO	6012	7/9/90	
A2	REVISED PER ECO # 6703	6703	11/2/90	
A3	REVISED PER ECO# 6955		2/26/92	
A4	REVISED PER ECO# 7003		2/27/92	
A5	REVISED PER ECO# 7046 CONSOLIDATED ENTS. 2-6 INTO NEW ENTS. 2&3		10 FEB 92	
A6	REVISED PER ECO# 7418		3/9/93	
A7	REVISED PER ECO# 7469		3/29/93	
A8	REVISED PER ECO# 7524		6/22/93	



COMPONENTS



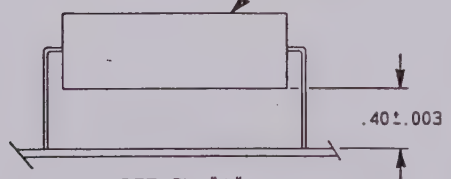
DETAIL "B"

REF. 23-55200-020
PAGE B-9

.90 MAX. HEIGHT

(495) REF

.09 MAX. LEAD LENGTH



DETAIL "A"
SCALE: NONE

SEE SEPARATE B/M 23-55200-020

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS (.XX) ± .01 FRACTIONS ±—
DECIMALS (.XXX) ±— ANGLES ± —

NEXT ASSY	PRODUCT
21-55200-010	5200

APPROVALS		DATE
DRAWN	ROGER	1.18.90
CHECKED	PKFISHER	1.19.90
ENGINEER	THOMAS FENN	4-27-90
ENG MGR	JOHN TEETER	5/2/90
RELEASED		

telcom

ASSY, PC - 5200 ANALOG

DIST | DWG NO. 23-55200-020 | REV A8

SIZE D | SCALE NONE | SHEET 1 OF 3

87680

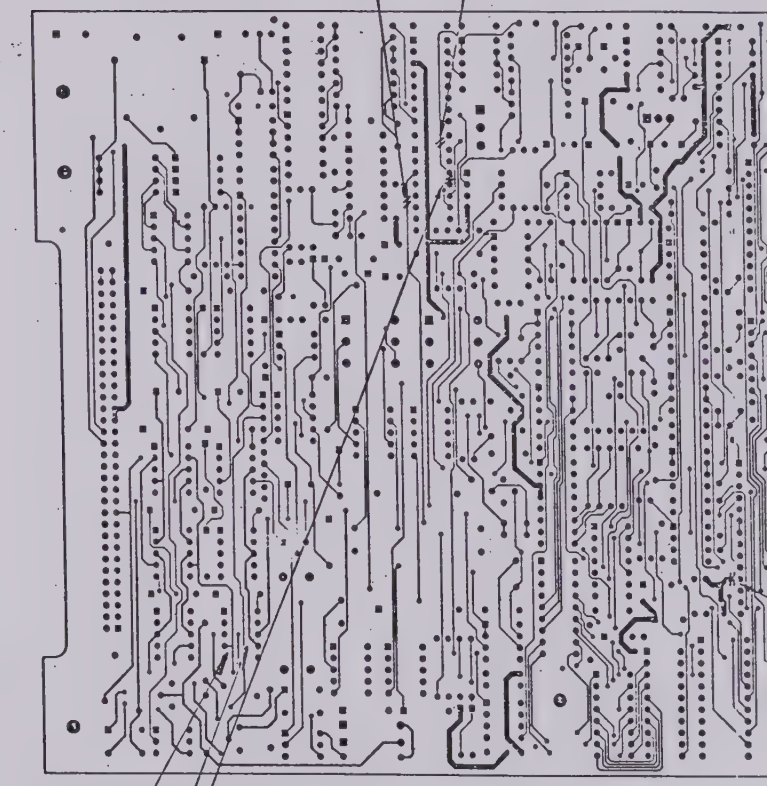
A B

1 2 3 4

COMPONENT SI

CUT TRACE FROM U4-3 TO

CUT TRACE FROM U13



58-55228-020 REV A COMP SIDE

CUT TRACE FROM U4-11 TO U4-12

CUT TRACE FROM K14-7 TO K13-8

CUT TRACE FROM K14-4 TO K2-7

8. CUT TRACES WHERE SHOWN ONLY.

NOTES- UNLESS OTHERWISE SPECIFIED:

BRUNING 40-522

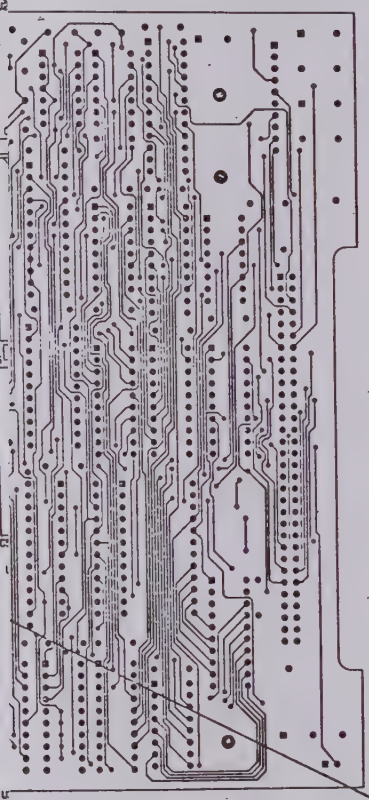
FORM NO. 98-00005-060

REV	DESCRIPTION	DATE	ECO	APPROVED

)E (REV. A FAB)

:EDTHRU (U37-14)

TO U4-12



CUT TRACE FROM U19-11 TO C73 (WHERE SHOWN ONLY)

QTY -020	QTY -010	ITEM	AJ PART NUMBER	DESCRIPTION	VENDOR OR APPROVED EQUIVALENT	VENDOR PART NO.	REF DESIG.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

TOLERANCES:
DECIMALS (.XX) ± —— FRACTIONS ± ——
DECIMALS (.XXX) ± —— ANGLES ± ——

NEXT ASSY	PRODUCT
21-55200-010	5200

DRAWN M.E. SEELEY 1-7-92
CHECKED M.C. Dudley 1-7-92
ENGINEER
MANAGER
MFG
QA
SERVICE
RELEASED

CXR telcom
521 CHARCOT AVE.
SAN JOSE, CA. 95131

ASSY, PC-5200 ANALOG

DIST. CODE	DWG NO.	REV
	23-55200-020	A8

SIZE C | SCALE NONE | SHEET 2 OF 3

87680

A B

1 2 3 4

SOLDER SIDE

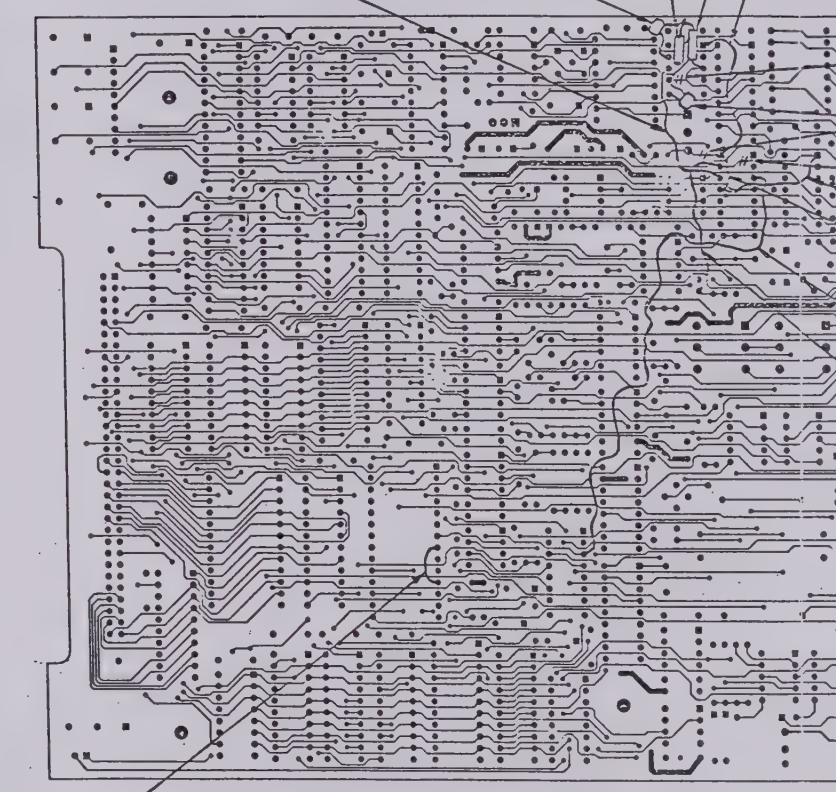
ADD JUMPER FROM U13-6 TO U4-12

ADD C128 (82-00035-010) FROM U13-7

ADD R87 (

ADD R

ADD



ADD JUMPER FROM U19-8 TO U19-11

11. CUT TRACES WHERE SHOWN ONLY.

10. FOR JUMPERS USE 26 AWG. SOLID, GREEN KYNAR WIRE (CYR
ROUTING SHOWN IS FOR CLARITY ONLY.

9. INSULATE ALL EXPOSED COMPONENT LEADS WITH TEFLON TUBING

NOTES- UNLESS OTHERWISE SPECIFIED:

BRUNING 40-522

FORM NO. 98-00005-060

REV	DESCRIPTION	DATE	ECO	APPROVED

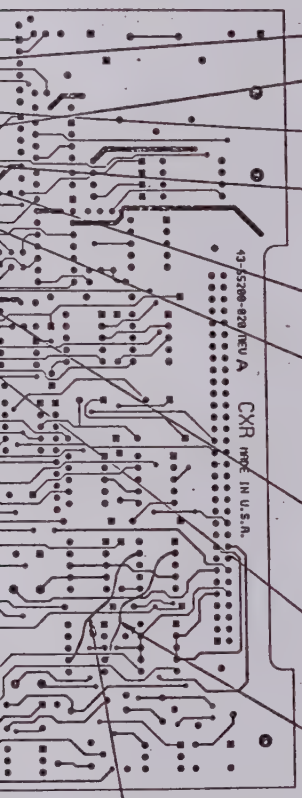
(REV. A FAB)

O R86 & R87 LEADS AS SHOWN

-41225-010) FROM U13-5 TO C128 & R86 LEADS AS SHOWN.

6 (72-23225-010) FROM U13-3 TO C128 & R86 LEADS AS SHOWN.

JUMPER FROM U13-1 TO U4-14



CUT TRACE FROM U13-5 TO U13-3 & U3-12

CUT TRACE FROM U4-14 TO P3-3

ADD C129 (82-00039-040) FROM U13-5 TO C24-GND AS SHOWN.

CUT TRACE FROM U4-13 TO U5-1

ADD JUMPER FROM U4-11 TO U5-1

ADD JUMPER FROM U4-14 TO U4-11

ADD JUMPER FROM U4-3 TO U48-3

ADD JUMPER FROM U4-13 TO C10 AS SHOWN (THE SIDE OF C10 THAT IS CONNECTED TO R21).

ADD JUMPER FROM K14-4 TO K2-2

ADD JUMPER FROM K14-7 TO K2-9

QTY -020	QTY -010	ITEM	AJ PART NUMBER	DESCRIPTION	VENDOR OR APPROVED EQUIVALENT	VENDOR PART NO.	REF DESIG.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

TOLERANCES:
DECIMALS (.XX) ± —— FRACTIONS ± ——
DECIMALS (.XXX) ± —— ANGLES ± ——

NEXT ASSY	PRODUCT
21-55200-010	5200

P/N 37-26555-230)

AS REQUIRED.

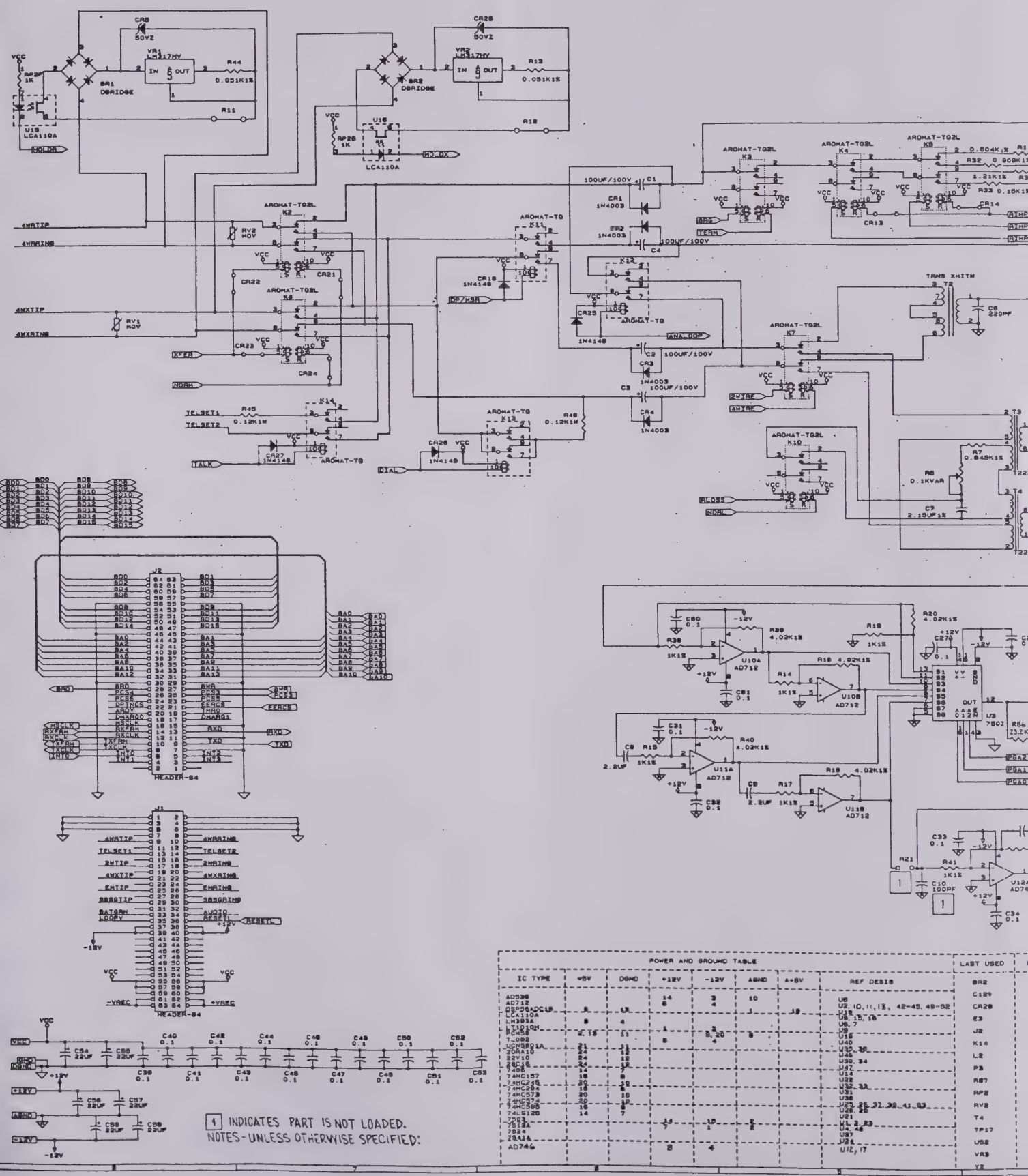
DRAWN	M. E. SEELEY	1-7-92
CHECKED	M.E. Seeley	1-7-92
ENGINEER		
MANAGER		
MFG		
QA		
SERVICE		
RELEASED		

CXR telcom 521 CHARCOT AVE. SAN JOSE CA. 95131

ASSY, PC-5200 ANALOG

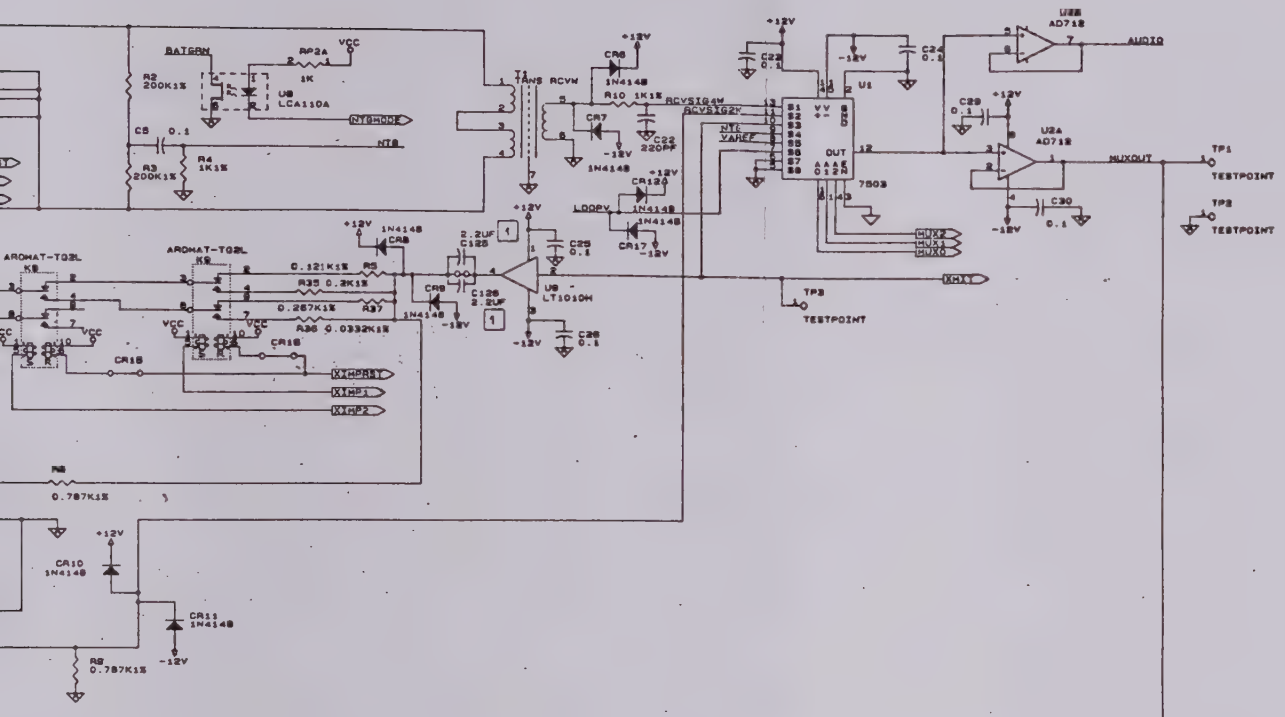
DIST. CODE	DWG NO.	REV
	23-55200-020	A8

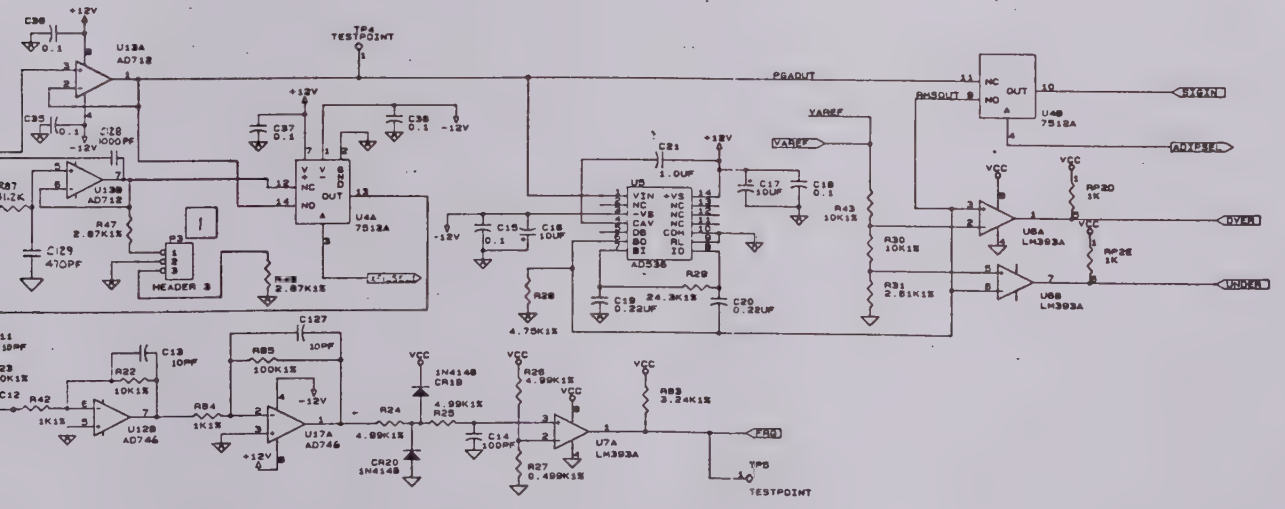
SIZE C | SCALE NONE | SHEET 3 OF 3

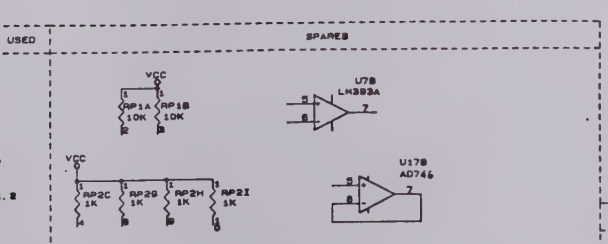


POWER AND GROUND TABLE								LAST USED
IC TYPE	+5V	DGND	+12V	-12V	AGND	A+5V	REF DESIG	BR2
AD536			14	2	10		U5	C129
AD712			8	4			U2, 10, 11, 13, 42-45, 48-52	CR28
DSP56ADCLP	8	13			5	18	U18	E3
LCA110A							U6, 15, 16	J2
LM393A	8	4					U6, 7	K14
L1010M			1	3			U9	L2
PCM58	2.15	11		5, 20	8		U15	P3
TL082			8	4			U40	R87
UCN5891A	21	11					U35, 36	RP2
20RA10	24	12					U46	RV2
22V10	24	12					U30, 34	T4
68C18	24	12					U37	TP17
7408	14	7					U14	U52
74HC157	16	8					U28	VR3
74HC245	20	10					U32, 33	Y2
74HC284	16	8					U31	
74HC573	20	10					U38	
74HC574	20	10					U29, 26, 27, 39, 41, 53	
74HC595	16	8					U24, 25	
74LS126	14	7					U21	
7203			14	15	5		U1, 2, 23	
7818A			1	3	2		U4, 48	
7824							U27	
2542A			8	4			U24	
AD746							U12, 17	

REV	DESCRIPTION	DATE	APPROVED
A	RELEASED PER DBN #5200	5/2/90	
A1	REVISED PER ECO# 6612	1/9/90	
A2	REVISED PER ECO #6703	11/26/90	
A3	REVISED PER ECO# 6955	2/27/92	
A4	REVISED PER ECO# 7418	3/9/93	
A5	REVISED PER ECO# 7469	3/9/93	
A6	REVISED PER ECO# 7524	6/22/93	







REF. 23-55200-020
PAGE B-9

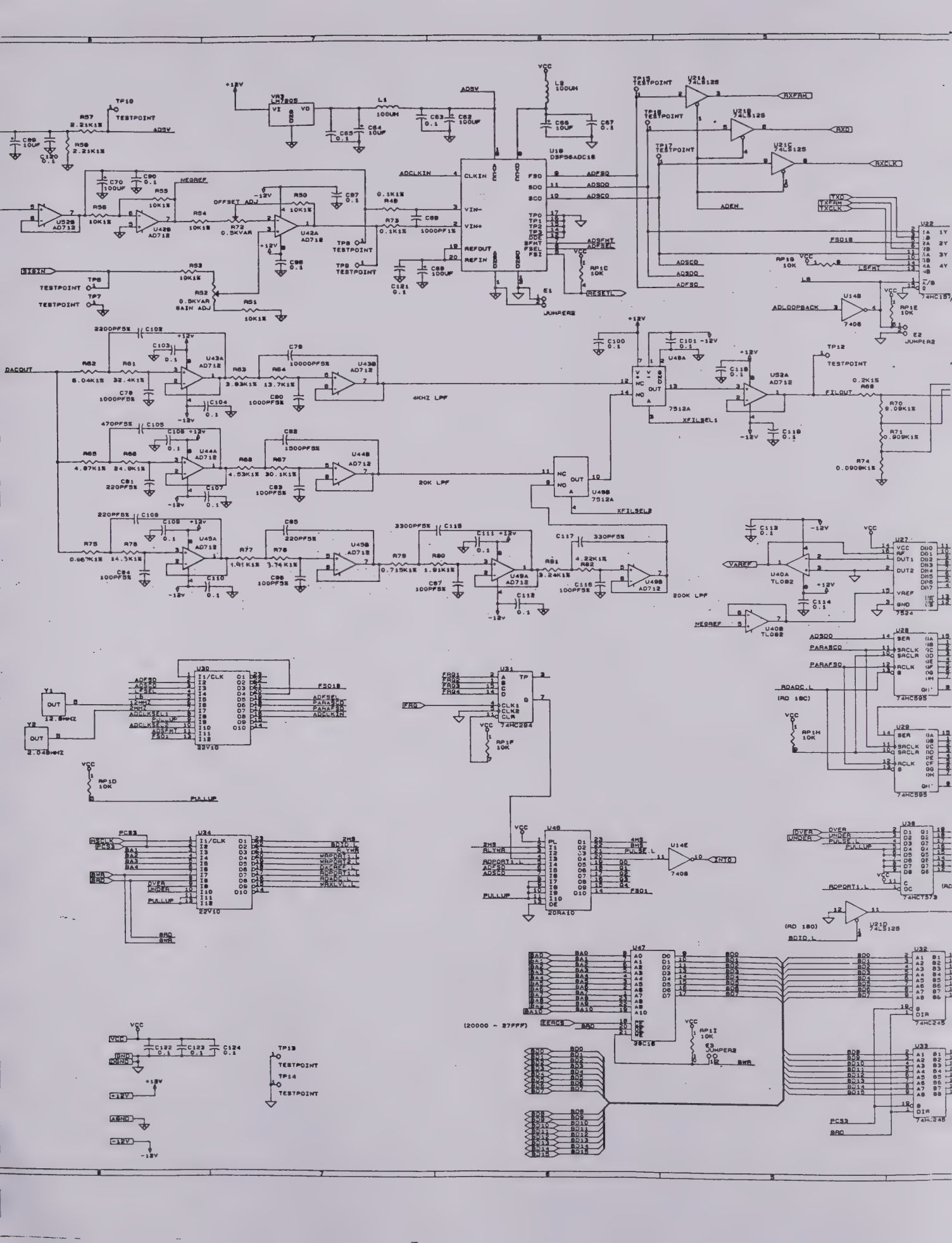
		DATE
DRAWN BY	THOMAS FENN	
CHECKED BY		2/2/90
PROJ ENG		2/2/90
ENG MGR		5/2/90
RELEASED		

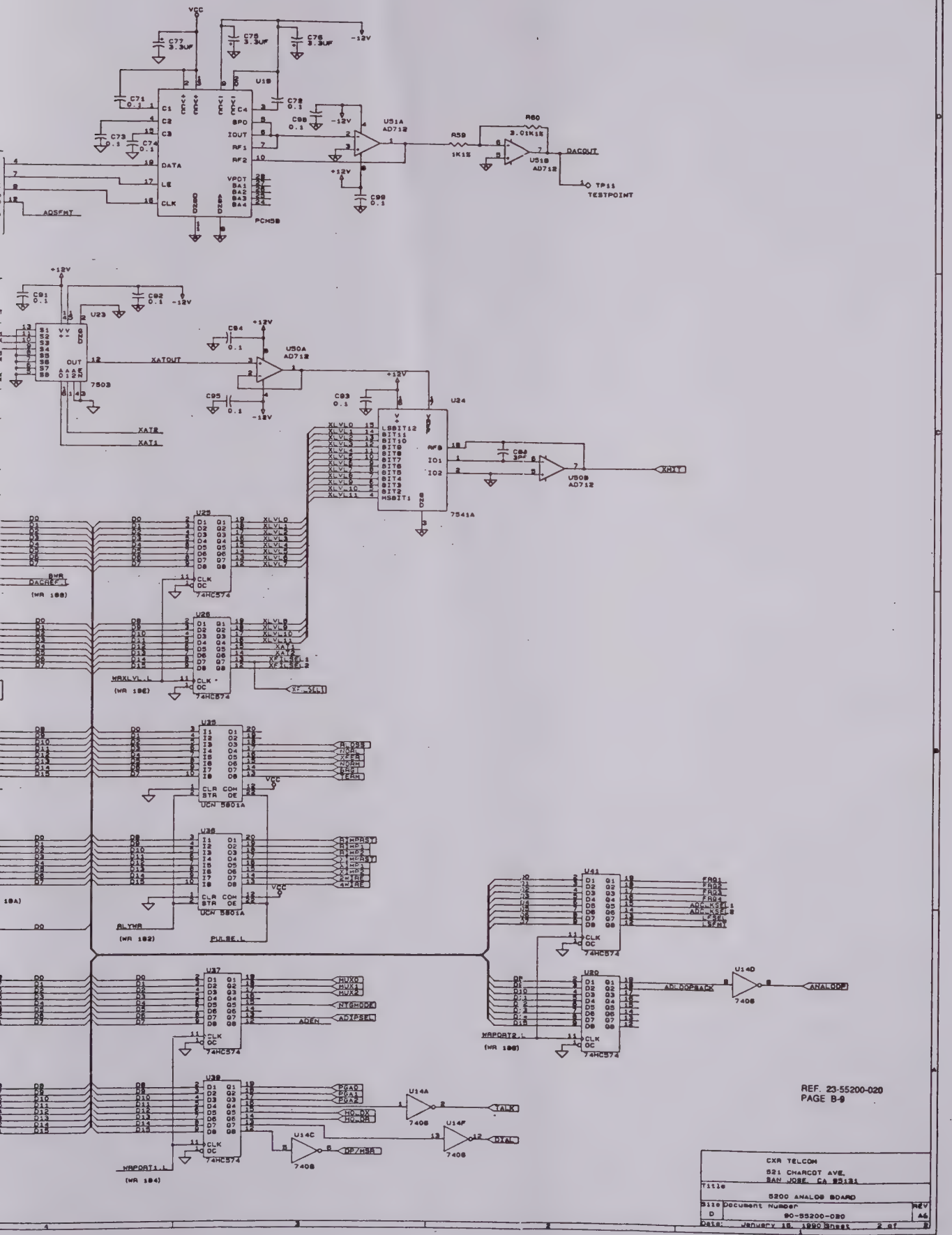
CXR TELCOM
521 CHARCOT AVE.
SAN JOSE, CA 95131

Title: 5200 ANALOG BOARD

Size: D | Document Number: 80-55200-020 | REV: A6

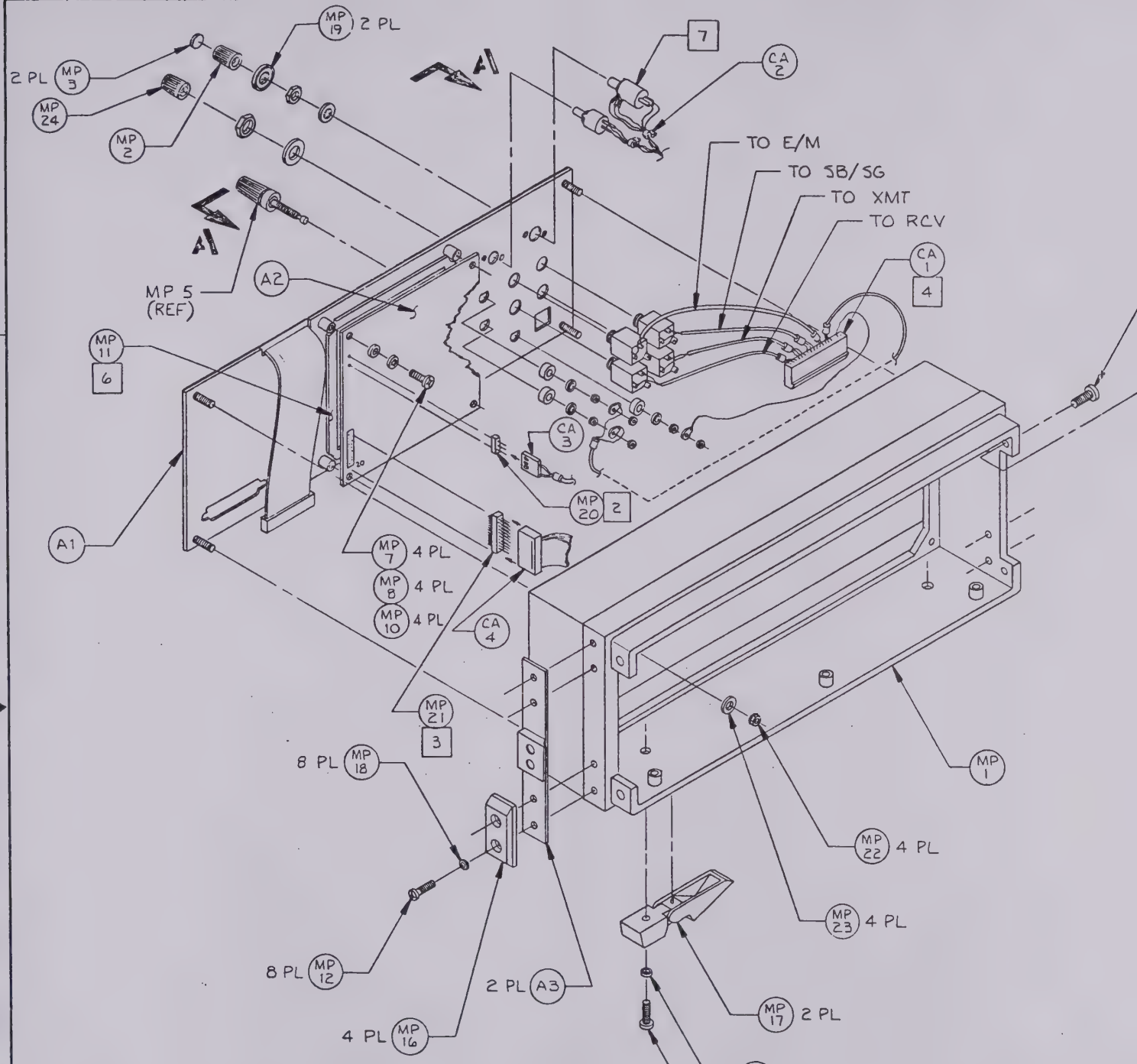
Date: JANUARY 18, 1990 | Sheet: 1 of 2





REF. 23-55200-020
PAGE B-9

CXR TELCOM 521 CHARCOT AVE. SAN JOSE, CA 95131		
Title: 5200 ANALOG BOARD		
Size: D	Document Number: 90-55200-020	REV: A6
Date: January 16, 1990	Sheet: 2 of 8	



7 REMOVE KEYING TAB PRIOR TO INSTALLATION INTO FRONT PANEL LABEL ASSEMBLY (A1).

6 CLEAN APPROPRIATE AREA OF FRONT PANEL (A1) WITH ISOPROPYL ALCOHOL PRIOR TO ADHERING GASKET (MP11).

5. UNIDENTIFIED HARDWARE IS INCLUDED WITH PARTS SUPPLIED.

4 INSTALL JACKS OF CA1 PER GRAPHICS IN VIEW A-A.

3 CLIP PIN 20 OF MP 21 AFTER SOLDERING TO A2. (THIS PROVIDES KEYING FOR CA4.)

2 PRIOR TO SOLDERING MP 20, CLIP CENTER PIN TO MATCH HOLE SPACING OF A2, AS SHOWN.

1 SEE SEPARATE MATERIAL LIST 26-55200-011.

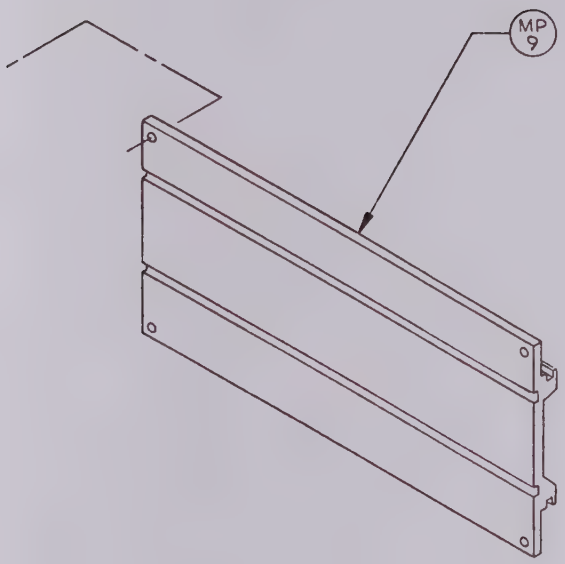
NOTES — UNLESS OTHERWISE SPECIFIED:

DWG. NO. 26-55200-011	SH 1	REV. A

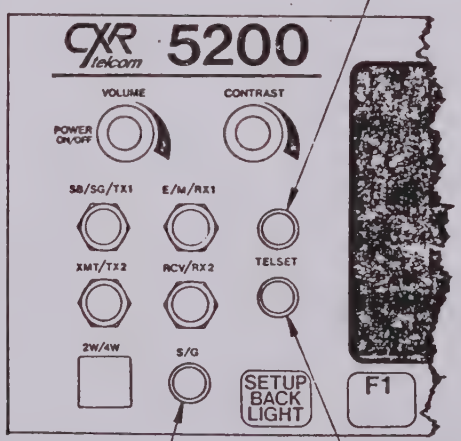
REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASE PER DRN 5200-02	3/23/93	M.E. Seeley

(MP 13) 2 PL



(TO WHT WIRE OF CA1) (MP 4)



(TO GRN. WIRE OF CA1) (MP 6)

(MP 5) (TO BLK WIRE OF CA1)

VIEW A-A

REF. 26-55200-011
PAGE B-12

ITEM NO.	QTY. REQD.	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

		5200
	NEXT ASSY	USED ON
QTY. PER	APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± — DECIMALS .XX ± — .XXX ± — ANGLES ±

MATERIAL 1

FINISH —

DO NOT SCALE DRAWING

CONTRAC. NO. —

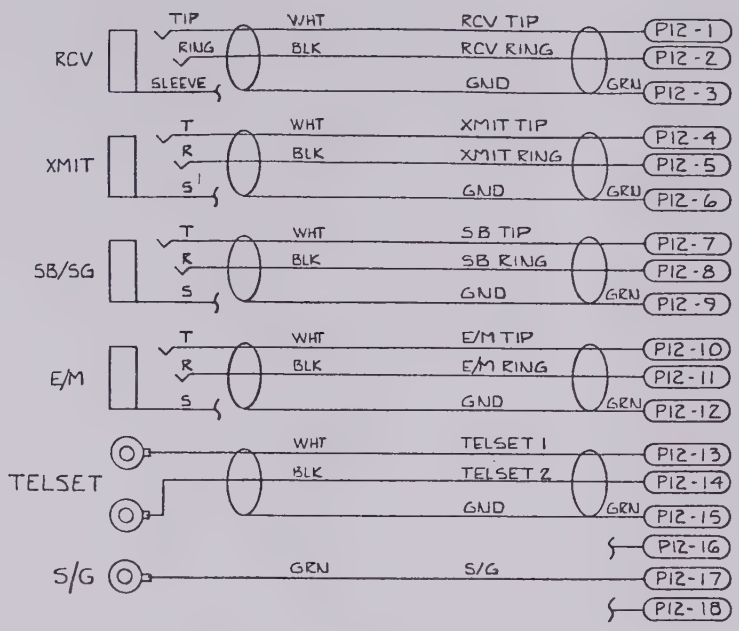
APPROVALS	DATE
DRAWN M.E. SEELEY	2-12-93
CHECKED M.E. Seeley	2/12/93
QA	
PROJECT ENG	3.19.93
ENG MANAGER John Smith	3/23/93

CXR telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

FRONT PANEL ASSY, 5200-02

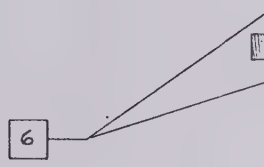
SIZE	FSCM NO	DWG. NO.	REV
D	—	26-55200-011	A

SCALE NONE — SHEET 1 OF 1



SCHEMATIC

VIEW A-A



6

[6] INSULATE SOLDER CONNECTIONS ON EACH JACK (8 PL) AND CABLE (5PL) WHERE SHOWN. USE .50 LONG (APPROX.) X 3/16 DIA. HEAT SHRINK TUBING MIL 23053B/5 (ITEM B).

[5] CONNECT GREEN WIRE FROM ITEM 7 (SHIELD CONNECTOR) TO ITEM 1 (CONNECTOR HOUSING), 5PL. INSTALL PER SCHEMATIC AND MANUFACTURER'S SUGGESTED INSTALLATION PROCEDURE.

4. BAG CABLE ASSEMBLIES WITH MOUNTING HARDWARE INDIVIDUALLY.

[3] STAMP ITEM 5 WITH CXR P/N 25-55200-020 AND CURRENT REVISION LEVEL USING BLACK PERMANENT INK.

[2] WIRE TO BE GREEN 24 AWG, 7X32 BUNCH TINNED, MIL-W-16878 TYPE "B". STRIP WIRE APPROX. .25 AND SOLDER TO ITEM 6 PER SCHEMATIC AND CABLE DRAWING.

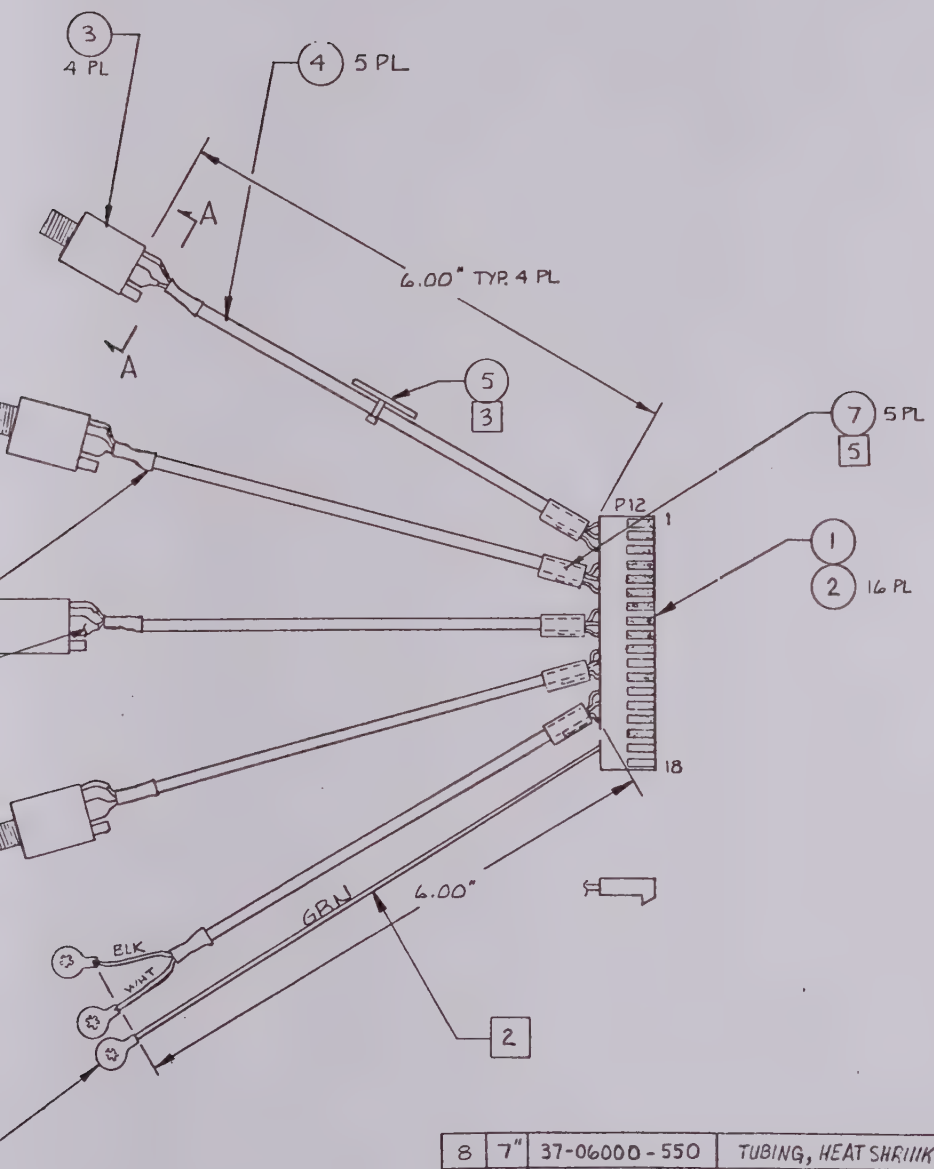
[1] USE PARTS SPECIFIED OR EXACT EQUIV. ONLY.

NOTES — UNLESS OTHERWISE SPECIFIED:

DWG. NO.	SH	REV.
25-55200-020	1	D

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
—	A	REL. PER DRN # 5200	1-18-90	[illegible]
—	B	REVISED ITEM 3, ADDED ITEM 8 PER ECO # 6596A	10 APR 90	[illegible]
—	C	REVISED PER ECO # 6847	9/23/91	[illegible]
—	D	REVISED PER ECO # 7197	9/8/92	[illegible]



REF. 25-55200-020
PAGE B-12

ITEM NO	QTY. REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
8	7"	37-06000-550	TUBING, HEAT SHRINK, 3/16 DIA., BLACK	ICO RALLY HIX-3/16 BLACK
7	5	34-00437-010	CONN, CABLE SHIELD, .345 TIN BLUE	THOMAS & BETTS RSKZ01 BLUE
6	3	53-00141-060	TERMINAL, LUG, SOLDER #6. LK	KULKA SMITH 1412-6
5	1	42-00252-010	CABLE-TIE MARKER, .75 DIA	PANDUIT-PLM1M
4	34"	37-00141-800	CABLE, SHIELDED, 2 x 24 AWG., 600V	NATIONAL WIRE N3193&N25J (BLK/WHT)
3	4	34-00448-010	CONN, 310 TEL JACK	SWITCHCRAFT-M-112B
2	16	34-00072-010	CONTACT, 18-24 GA.	MOLEX-08-50-0106
1	1	34-00077-180	CONN., SHELL, RECEPT., 18 POS, .156 SP.	MOLEX-09-50-3181

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± — DECIMALS .XX ± .25 .XXX ± — ANGLES ± —

MATERIAL: 1

FINISH: —

DO NOT SCALE DRAWING

CONTRACT NO. —

APPROVALS		DATE
DRAWN	Tim I.	9-18-89
CHECKED	[illegible]	1-16-90
QA		
PROJECT ENG.	[illegible]	1-18-90
ENG. MANAGER	John Gerber	1/16/90

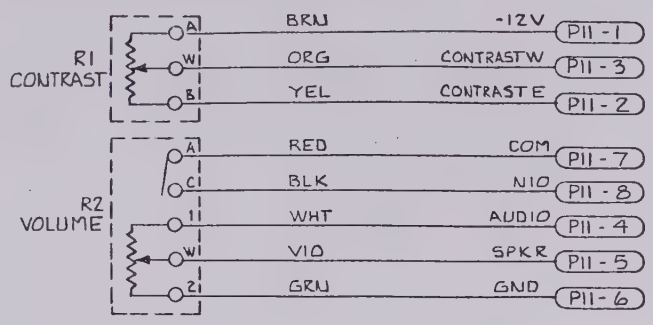
CXR telecom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

CABLE,
XMIT / RECEIVE TEL JACK,
5200

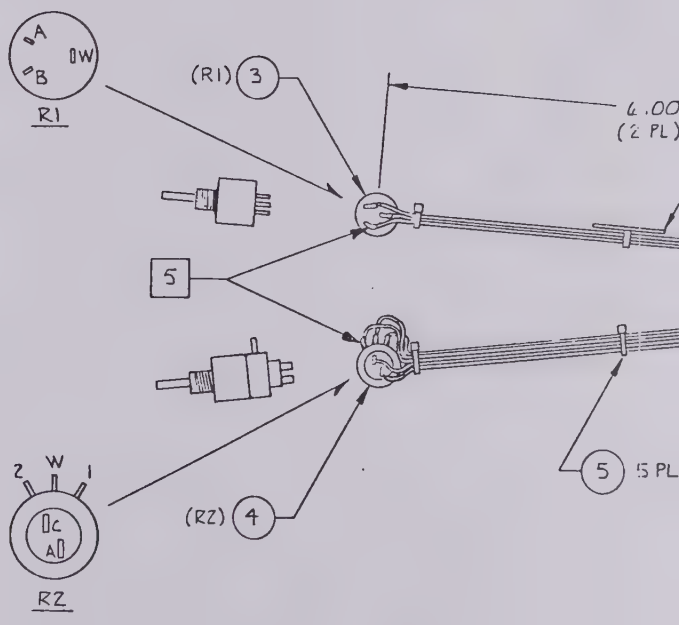
SIZE	FSCM NO.	DWG. NO.	REV.
D	—	25-55200-020	D

SCALE NONE SHEET 1 OF 1

QTY. PER	APPLICATION	
	NEXT ASSY	USED ON
		5200



SCHEMATIC



[5] INSULATE SOLDER CONNECTIONS ON R1 AND R2 (8 PL) USING .50 LONG (APPROX.) X 3/32 DIA. HEAT SHRINK TUBING MIL 23053B/5.

4. BAG CABLE ASSEMBLIES AND MOUNTING HARDWARE INDIVIDUALLY.

3. STRIP WIRES APPROX. .25 AND SOLDER TO ITEMS 3 AND 4 PER SCHEMATIC AND CABLE DRAWING.

[2] STAMP ITEM 6 WITH CXR P/N 25-55200-030 AND CURRENT REV. LEVEL USING BLACK PERMANENT INK.

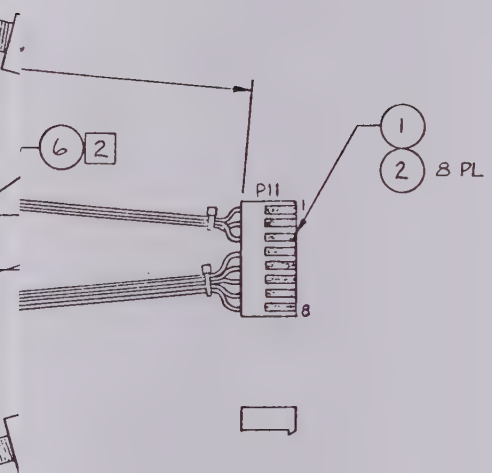
[1] USE PARTS SPECIFIED OR EXACT EQUIV. ONLY.
FOR WIRES USE 24 AWG., 7 x 32 STRAND, BUNCH TINNED, MIL-W-16878 TYPE "B". COLOR PER SCHEMATIC.

NOTES — UNLESS OTHERWISE SPECIFIED:

DWG. NO.	SH	REV.
25-55200-030	1	B

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
—	A	REL. PER DRN # 5200	1-18-90	M.E. Seeley
—	B	REVISED PER ECO# 6951	3/3/91	M.E. Seeley



REF. 25-55200-030
PAGE B-13

PURCHASED ASSY

ITEM NO.	QTY. REQD.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
6	1	42-00252-010	CABLE TIE, MARKER, .75 DIA.	PANDUIT-PLM1M
5	5	42-00003-010	CABLE TIE, .75 DIA.	PANDUIT-SST1M
4	1	79-00178-010	R-VAR, W/SWITCH, 10K, 1/2 W, 10%	SUPPLIED BY CXR
3	1	79-00160-011	R-VAR, PNL, 1T, 10K, 1/2 W, 10%	SUPPLIED BY CXR
2	8	34-00072-010	CON-CONTACT, 18-24 AWG.	MOLEX-08-50-0106
1	1	34-00077-080	CON-HOUSING RECPT, 8 POS, .156 SP.	MOLEX-09-50-3081

PARTS LIST

QTY. PER	APPLICATION	
		5200
	NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± —— DECIMALS XX ± .25 XXX ± —— ANGLES ± ——

MATERIAL [1]

FINISH ——

DO NOT SCALE DRAWING

CONTRACT NO. ——

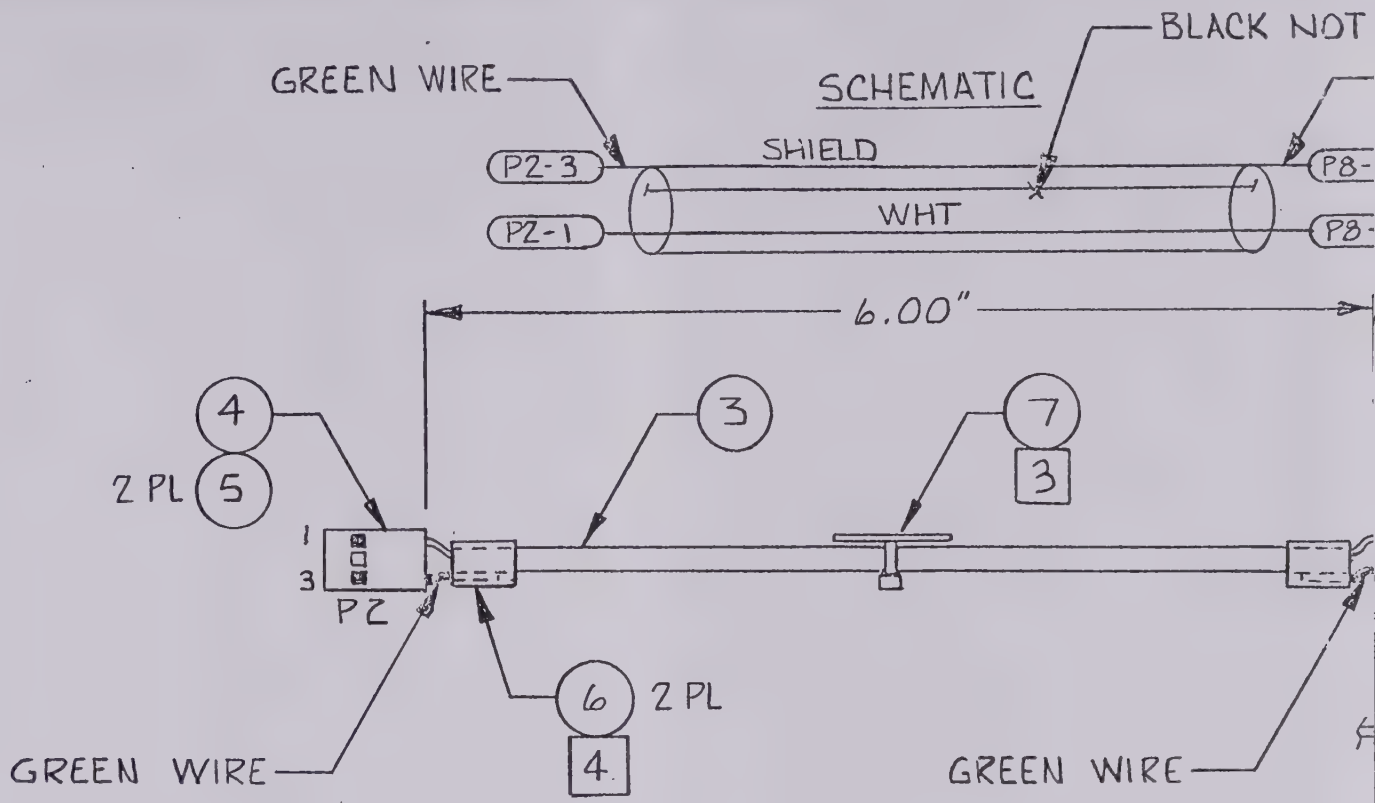
APPROVALS		DATE
DRAWN	T.M.I.	9-22-89
CHECKED	M.E. Seeley	1-16-90
QA		
PROJECT ENG.	C. Lin	1-18-90
ENG MANAGER	John Seeley	1/18/90

CXR Telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

CABLE,
CONTRAST / VOLUME,
5200

SIZE	FSCM NO.	DWG. NO.	REV.
D	—	25-55200-030	B

SCALE NONE SHEET 1 OF 1



ITEM NO.	QTY REQD
7	1
6	2
5	2
4	1
3	7"
2	2
1	1

[4] CONNECT GREEN WIRES FROM ITEM 6 (2PL) TO ITEMS 1 AND 4 PER SCHEMATIC AND CABLE DRAWING. INSTALL PER MANUFACTURER'S INSTALLATION PROCEDURES.

[3] STAMP ITEM 7 WITH CXR P/N 25-55200-020 AND CURRENT REVISION LEVEL USING BLACK PERMANENT INK.

2. FOR ALL WIRES USE GREEN 24 AWG, 7 x 32 BUNCH TINNED, MIL-W-16878 TYPE "B".

[1] USE PARTS SPECIFIED OR EXACT EQUIV. ONLY.

NOTES - UNLESS OTHERWISE SPECIFIED:

UNLESS OTHER
DIMENSIONS AR
TOLERANCES A
FRACTIONS
±

MATERIAL

FINISH

DO NOT

		5200
	NEXT ASSY	USED ON
QTY. PER	APPLICATION	

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A49291

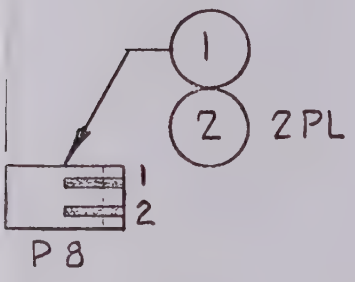
DWG. NO. 25-55200-040 | SH 1 | REV. A

USED
- GREEN WIRE

(2)

(1)

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	REL. PER DRN # 5200	1-18-90	M.E. Seeley



REF. 25-55200-040
PAGE B-13

PURCHASED ASSY

PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
42-00252-010	CABLE TIE, MARKER, .75 DIA.	PANDUIT-PLM1M
34-00437-010	CONN, CABLE, SHIELD, .345 TIN BLUE	THOMAS & BETTS RSK201 BLUE
34-00473-010	CON-CONTACT FEMALE	BERG-47745-000
34-00472-080	CON-HOUSING RECPT., 3 POS., .10 SP	BERG-65039-034
37-00141-800	CABLE-SHIELDED, 2 COND., 24AWG.	NATIONAL WIRE NB1936N2SJ B/W
34-00072-010	CON-CONTACT, 18-24 AWG	MOLEX-08-50-0106
34-00077-020	CON-HOUSING RECPT., 2 POS, .156 SP	MOLEX-09-50-3021

PARTS LIST

WISE SPECIFIED
E IN INCHES
RE:
ECIMALS ANGLES
X ± .25 ± ——
XX ± ——

1

——

SCALE DRAWING

CONTRACT NO. ——

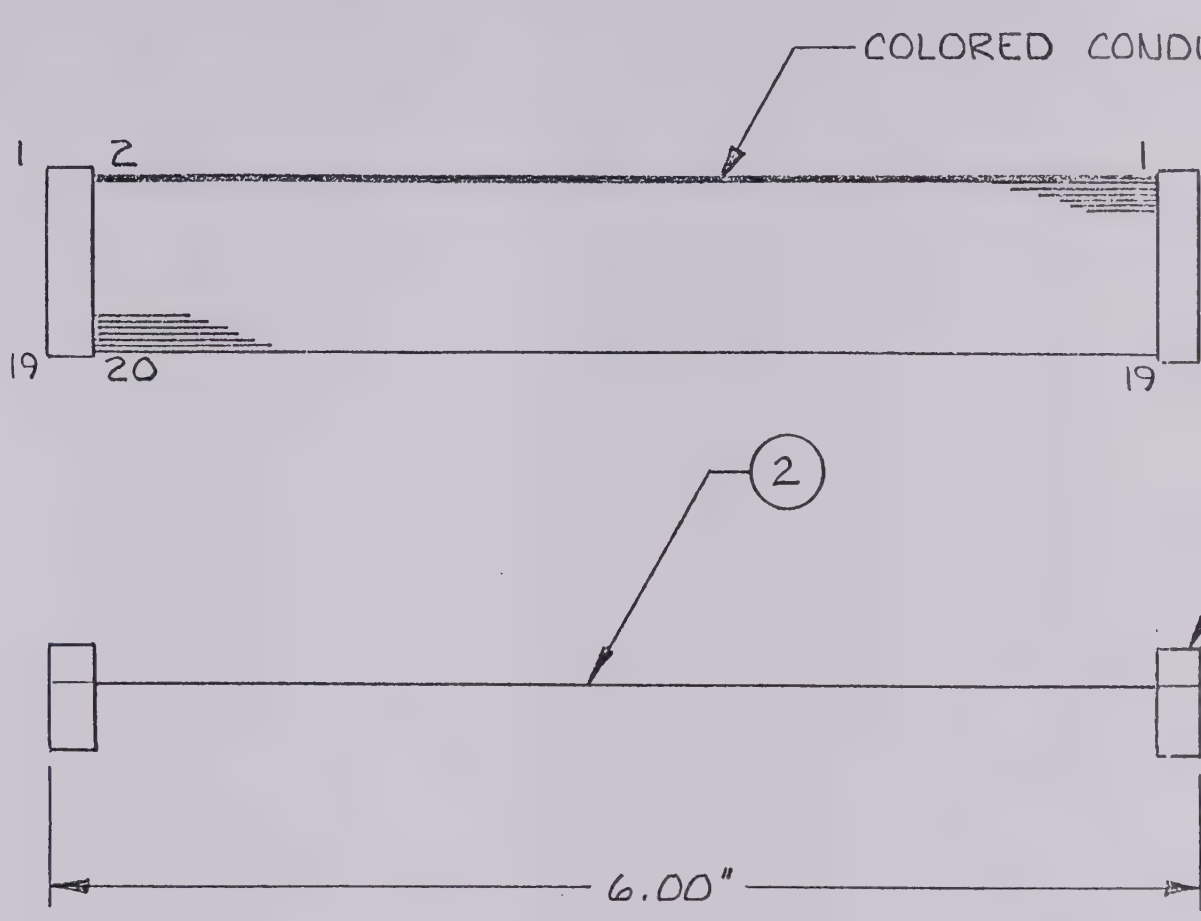
APPROVALS	DATE
DRAWN Tim I	9-18-89
CHECKED M.E. Seeley	1-16-90
QA	
PROJECT ENG. C. Lu	1-18-90
ENG MANAGER John Keeler	1/18/90

CXR telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

CABLE, BACKLIGHT, 5200

SIZE	FSCM NO.	DWG. NO.	REV.
B	——	25-55200-040	A

SCALE NONE | SHEET 1 OF 1



4 INSERT ITEM 3 (POLARIZING KEY) INTO POSITION 20 OF EACH ITEM 1.

3. INSTALL CONNECTORS WITH PIN 1 TO COLORED CONDUCTOR.

2 STAMP WITH CXR P/N 25-55200-050 AND CURRENT REVISION LEVEL USING CONTRASTING PERMANENT INK.

1 USE PARTS SPECIFIED OR EXACT EQUIV. ONLY.

NOTES - UNLESS OTHERWISE SPECIFIED:

		5200
	NEXT ASSY	USED ON
QTY. PER	APPLICATION	

3	2
2	6"
1	2
ITEM NO.	QTY REQD

UNLESS OTHER
DIMENSIONS A
TOLERANCES
FRACTIONS
±
MATERIAL
FINISH
DO NOT

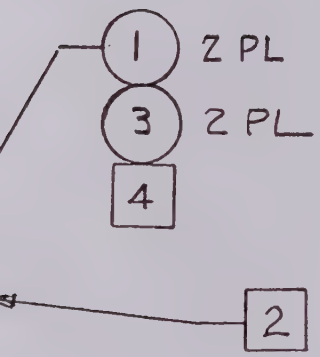
BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A49291

DWG. NO. 25-55200-050 SH 1 REV. A

CTOR

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	REL PER DRN # 5200	1-18-90	M.C. Seeley

LO



REF. 25-55200-050
PAGE B-13

PURCHASED ASSY

PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
42-00292-010	KEY, POLARIZING, CONNECTOR	3M- 3435-0
37-00053-800	CABLE, FLAT, .050 SP., 20 x 28 AWG.	3M -3365/20
34-00442-060	CONN, IDC RECEPT, 20 POS	3M -3421-6020

PARTS LIST

SE SPECIFIED
N INCHES
IMALS ANGLES
± .25 ± —
± —

—

CALE DRAWING

CONTRACT NO. —

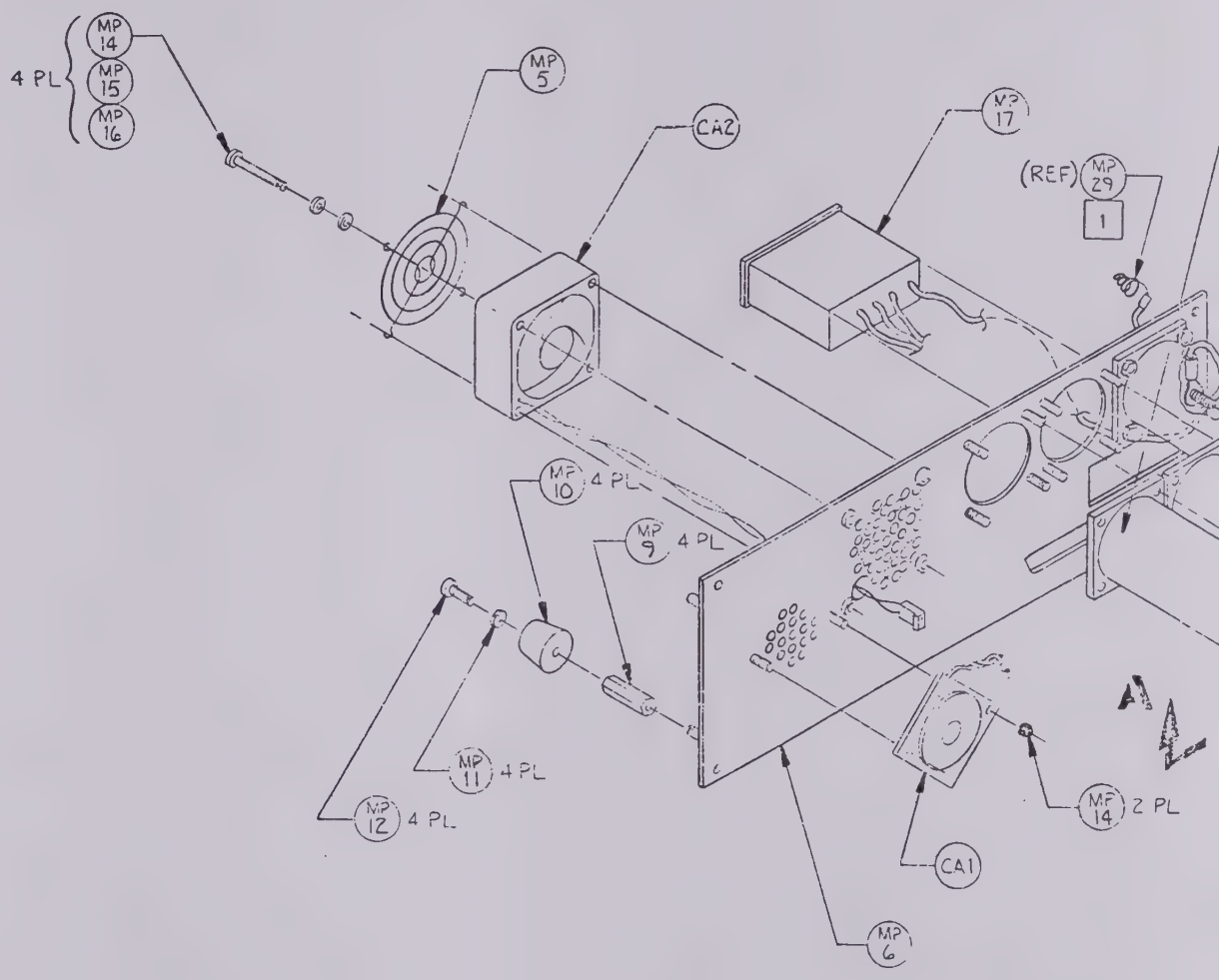
APPROVALS	DATE
DRAWN Tim I.	9-25-85
CHECKED M.C. Seeley	1-16-90
QA	
PROJECT ENG. C Lu	1-18-90
ENG. MANAGER John Serber	1/18/90

CXR telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

CABLE,
LCD DISPLAY, 5200

SIZE	FSCM NO.	DWG. NO.	REV.
B	—	25-55200-050	A

SCALE NONE SHEET 1 OF 1



2 REMOVE AND DISCARD EXISTING SPRING AND REPLACE WITH NEW SPRING (MP30). REPOSITION REAR BATTERY HOLDER SPRING STOP AND INSULATING STOP SO THAT LARGER TAB FACES DOWN THROUGH BOTTOM SLOT, AS SHOWN. (CAUTION: ENSURE THAT FIBER INSULATING STOP IS AGAINST NEW SPRING.)

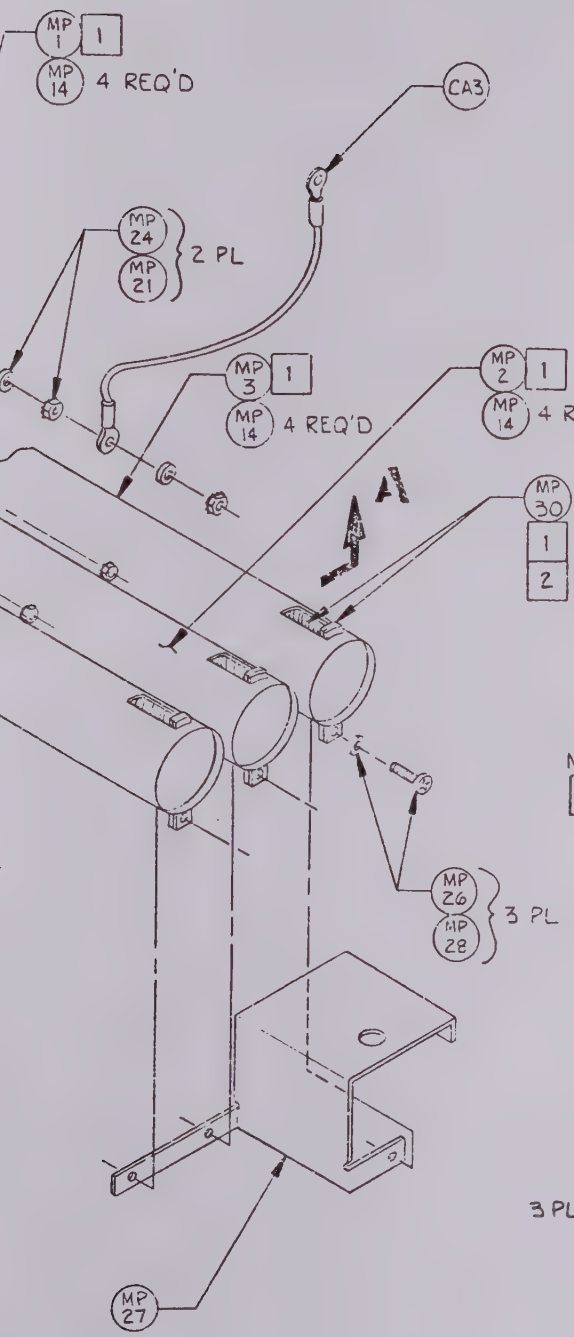
1 INSTALL SPRING WIRE HARNESS (MP29) IN BATTERY HOLDERS (MP1-3) AND SOLDER WIRES TO BATTERY CONNECTIONS PER VIEW A-A USING 20 AWG WIRE (UL TYPE 1007). COAT THOROUGHLY (SPRAY OR BRUSH C WITH CHEMTRONICS GOLD GUARD UV (P/N CB01V) AL EXPOSED METAL OF BATTERY HOLDERS (ALL SPR TABS, PLATES, EYELETS, ETC.). INSULATE SOLDER CONNECTIONS USING 3/16 DIAMETER HEAT SHRINK TUB (CXR P/N 37-06000-550). WIRES MAY BE SECURED WITH TIE WRAP (CXR P/N 42-00003-020).

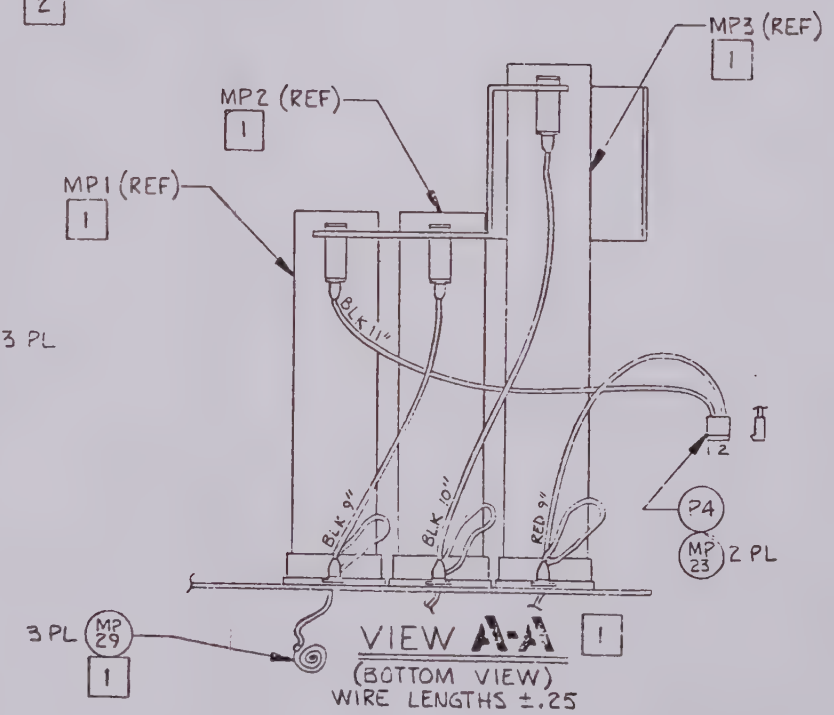
NOTES — UNLESS OTHERWISE SPECIFIED

DWG NO. 26-55200-0211 REV B

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	RELEASE PER CRN* 5200-02	3/27/73	
	B	REVISED PER ECO* 7618	6/16/93	





REF. 26-55200-021
PAGE B-14

SEE SEPARATE B/M 26-55200-021

PARTS LIST

ITEM NO	QTY PER	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS ± ANGLES ±
MATERIAL
FINISH
DO NOT SCALE DRAWING

CONTRACT NO

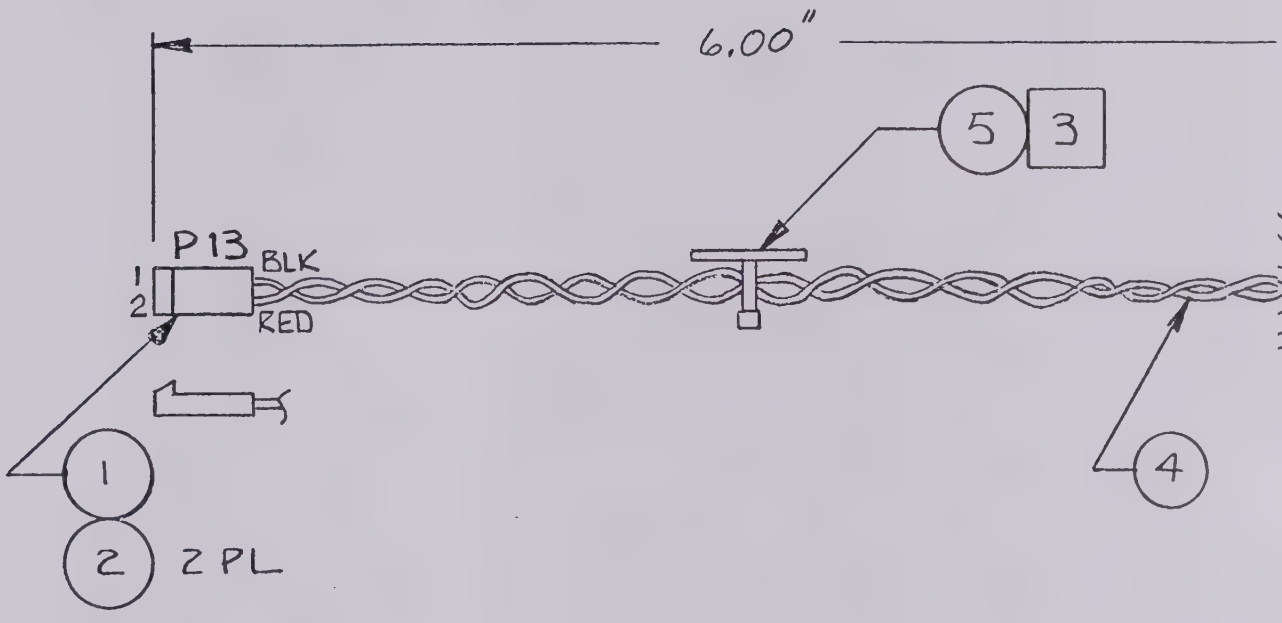
APPROVALS	DATE
DRAWN M. E. SEELEY	2/12/73
CHECKED	2/12/73
ENG APPROVAL	3.19.73
PROJECT ENG	3/23/73

CVR Division
521 CHARGOT AVENUE
SAN JOSE, CALIFORNIA 95131

REAR PANEL ASSEMBLY, 5200-02 (W/ BATT)

SIZE D | FSCM NO | DWG NO 26-55200-021 | REV B
SCALE NONE | SHEET 1 OF 1

QTY. PER	APPLICATION	USED ON
		5200
	NEXT ASSY	



4. BAG INDIVIDUALLY AND WRAP SPEAKER WITH ANTI-STATIC PROTECTIVE FOAM.

[3] STAMP ITEM 5 WITH CXR P/N 25-55200-060 AND CURRENT REVISION LEVEL USING BLACK PERMANENT INK.

[2] INSULATE SOLDER CONNECTIONS ON LS1 (2 PL) USING .50 LONG (APPROX.) X 3/32 DIA. HEAT SHRINK TUBING MIL 23053B/5.

[1] USE PARTS SPECIFIED OR EXACT EQUIVALENT ONLY

NOTES- UNLESS OTHERWISE SPECIFIED:

ITEM NO.	QTY REQD
5	1
4	6"
3	1
2	2
1	1

UNLESS OTHERW
DIMENSIONS ARE
TOLERANCES AR
FRACTIONS DE
± —— .XX
.XX

MATERIAL

FINISH

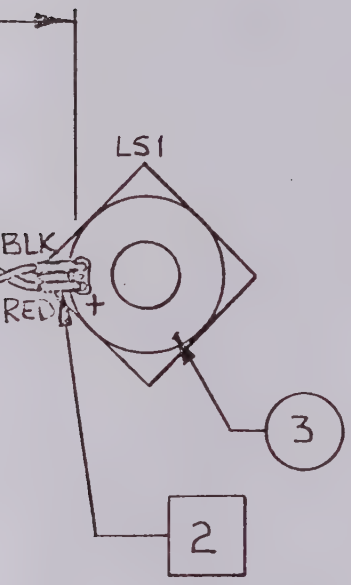
DO NOT

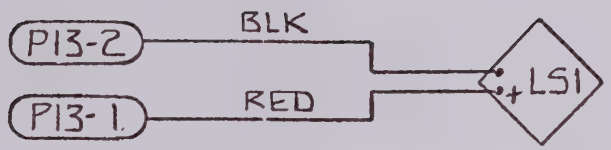
		5200
	NEXT ASSY	USED ON
QTY. PER	APPLICATION	

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A49291

DWG. NO. 25-55200-060	SH 1	REV. A

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	REL. PER DEN # 5200	1-18-90	M.C. Sulay





SCHEMATIC

PURCHASED ASSY

REF. 25-55200-060
PAGE B-14

CXR PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	VENDOR SPECIFICATION
42-00252-010	CABLE-TIE MARKER, .75 DIA	PANDUIT-PLM1M
37-00021-100	WIRE, TWIST, 2x24GA, 7x32, BLK/RED	ALPHA WIRE-1854
35-00031-010	SPEAKER, 8 OHM, 50MM x 40 MM	FUJI TS50-8 OHMS
34-00072-010	CONTACT, 18-24 AWG	MOLEX-08-50-0106
34-00077-020	CONN, HOUSING, RECEPT., 2 POS	MOLEX 09-50-3021

PARTS LIST

SE SPECIFIED
IN INCHES
E:
CIMALS ANGLES
± .25 ± —
X ± —

1

SCALE DRAWING

CONTRACT NO. —

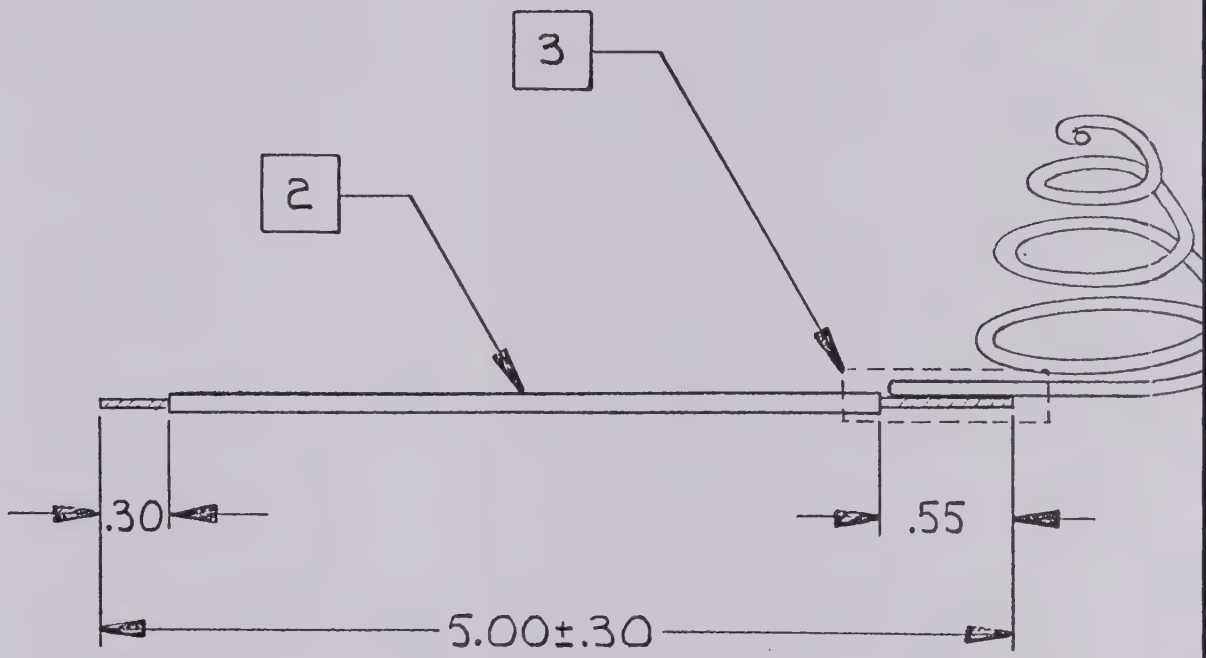
APPROVALS	DATE
DRAWN TMT.	9/15/89
CHECKED M.C. Sulay	1-16-90
QA	
PROJECT ENG.	1-18-90
ENG. MANAGER John Keeler	1/18/90

CXR telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

CABLE,
SPEAKER, 5200

SIZE	FSCM NO.	DWG. NO.	REV.
B	—	25-55200-060	A

SCALE NONE | SHEET 1 OF 1



4. BAG INDIVIDUALLY AND MARK WITH CXR P/N 25-55200-090 AND CURRENT REVISION LEVEL.

3 SOLDER WIRE TO SPRING'S TAIL AND INSULATE WITH 3/32 DIA. X 1.00 LONG HEAT SHRINK TUBING (CXR P/N 37-03000-550) APPROX. WHERE SHOWN.

2 FOR WIRE USE RED, 24 AWG., UL TYPE 1007 (CSA TYPE TR-64).

1 USE PARTS SPECIFIED OR EXACT EQUIVALENT ONLY.

NOTES- UNLESS OTHERWISE SPECIFIED:

ITEM NO.	QTY REQD
1	1

UNLESS CTHERW
DIMENSIONS AR
TOLERANCES A
FRACTIONS D
± .X
.X

MATERIAL

FINISH

NEXT ASSY	USED ON
21-55200-010	5200

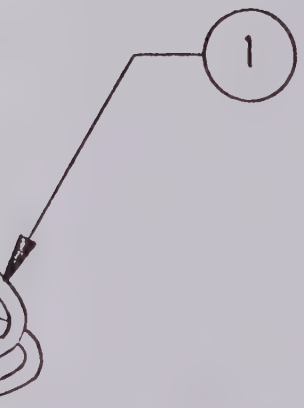
APPLICATION

DO NOT

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A49291

DWG. NO. 25-55200-090 | SH 1 | REV. A

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASED PER DRN* 5200	9/17/90	M.E. Seeley



REF. 25-55200-090
PAGE B-15

PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
54-00123-010	SPRING, CONTACT BATTERY HOLDER	SEE CXR SPEC.

PARTS LIST

VISE SPECIFIED
E IN INCHES
IE:
ECIMALS ANGLES
x ± .10 ± ——
XX ± ——

2

——

SCALE DRAWING

CONTRACT NO. ——

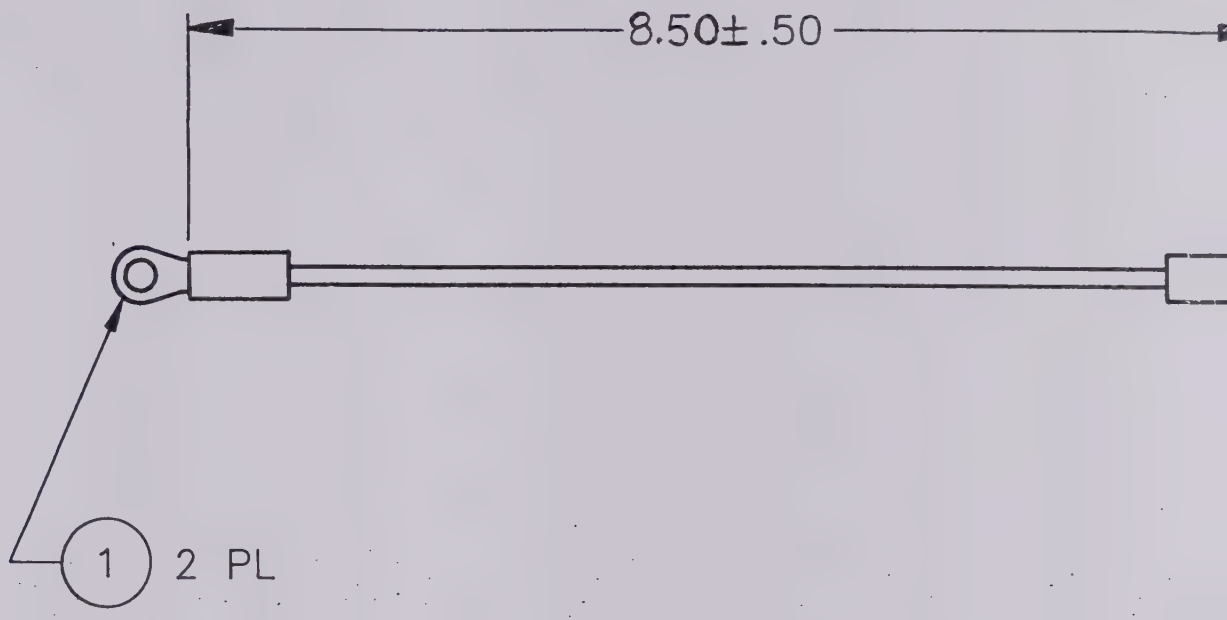
APPROVALS	DATE
DRAWN M.E. SEELEY	8-13-90
CHECKED M.E. Seeley	9-6-90
QA	
PROJECT ENG.	9.14.90
ENG. MANAGER John Reuter	9/17/90

CXR telcom
521 CHARCOT AVENUE
SAN JOSE, CALIFORNIA 95131

WIRE HARNESS,
SPRING, 5200

SIZE	FSCM NO.	DWG. NO.	REV.
B	——	25-55200-090	A

SCALE NONE —— SHEET 1 OF 1



2. FOR WIRE USE GREEN, 22 AWG 7 X 30 STRAND, BUNCHED TINNED, UL TYPE 1007 (CSA TR-64).

1. USE PARTS SPECIFIED OR EXACT EQUIVALENT ONLY.

1	2
ITEM NO.	QTY REQD.

UNLESS OTH
DIMENSIONS
TOLERANCES
.XX ± N/A
.XXX ± N/A

MATERIAL:

FINISH:

	NEXT ASSY.	USED ON
QTY. PER	APPLICATION	

DO NOT

NOTES- UNLESS OTHERWISE SPECIFIED:

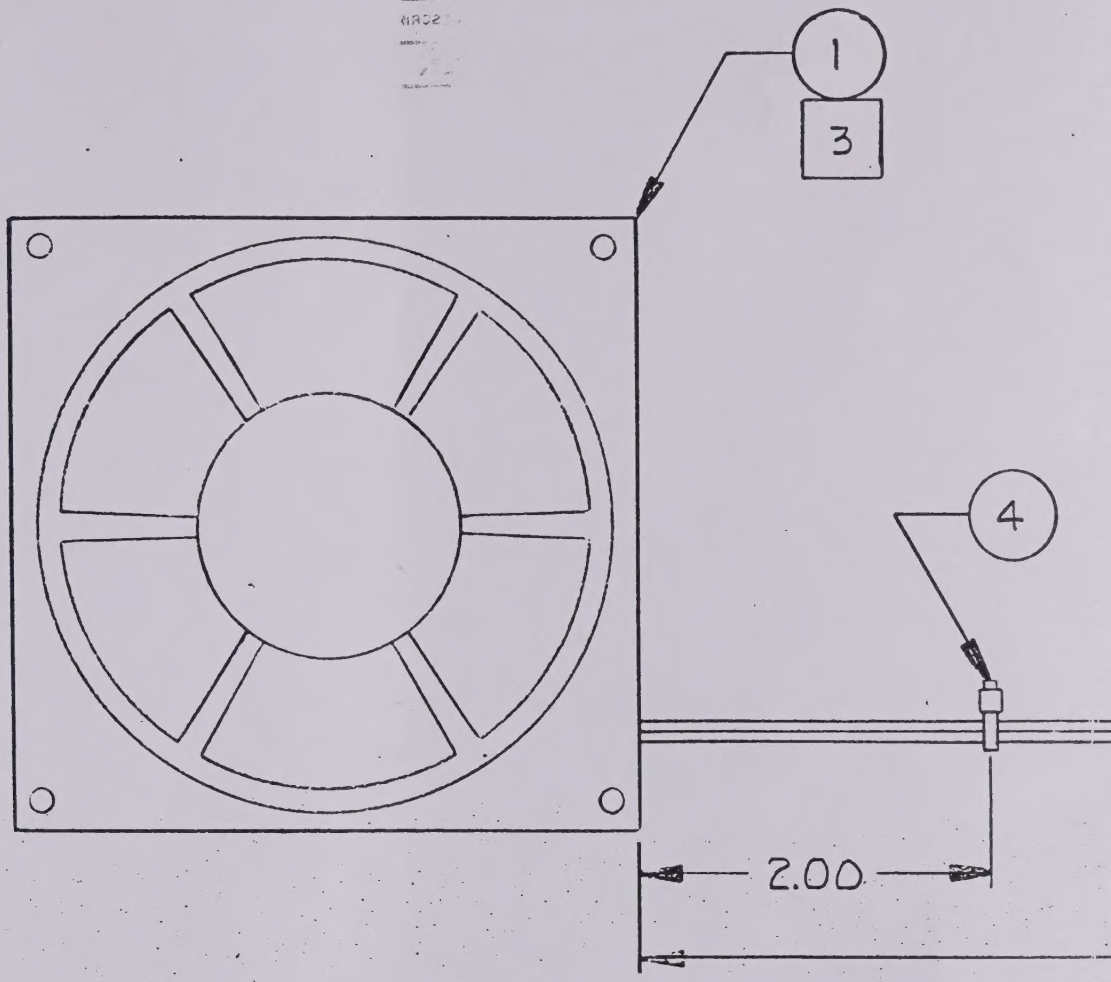
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASE PER DRN 5200-02	3/23/93	M.C. Seeley

REF. 25-55200-140
PAGE B-15

53-00052-080	TERMINAL, RING, INSUL., 22-18 AWG	HOLLINGSWORTH R4142FT1
PART OR IDENTIFYING NO.	NOMINCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

ERWISE SPECIFIED ARE IN INCHES ANG. ± N/A	CONTRACT NO.		CXR Telcom	521 CHARCOT AVENUE SAN JOSE, CALIFORNIA 95131
	APPROVALS	DATE		
	DRAWN MARK E. SEELEY	2-3-93	CABLE., GROUNDING, 5200-02	
	CHECKED M.C. Seeley	3/4/93		
	QA		SIZE B / FSCM NO. / DWG. NO. 25-55200-140 / REV. A	
	PROJECT ENG.	3/19/93		
SCALE DRAWING	ENG. MANAGER John Seeley	3/23/93	SCALE: NONE / ACAD FILE NO. 25520014.DWG / SHEET 1 OF 1	



4. BAG CABLE ASSEMBLIES INDIVIDUALLY.

3 FAN (ITEM 1) IS PROVIDED WITH APPROXIMATELY TWELVE INCHES OF WIRE.

2 MARK ITEM 5 WITH CXR P/N 25-55200-170 AND CURRENT REVISION LEVEL USING PERMANENT BLACK INK.

1 USE PARTS SPECIFIED OR EXACT EQUIVALENT ONLY.

NOTES-UNLESS OTHERWISE SPECIFIED:

ITEM NO.	QTY REQD
5	1
4	1
3	1
2	2
1	1

UNLESS OTHE
DIMENSIONS A
TOLERANCES
FRACTIONS
±

MATERIAL

FINISH

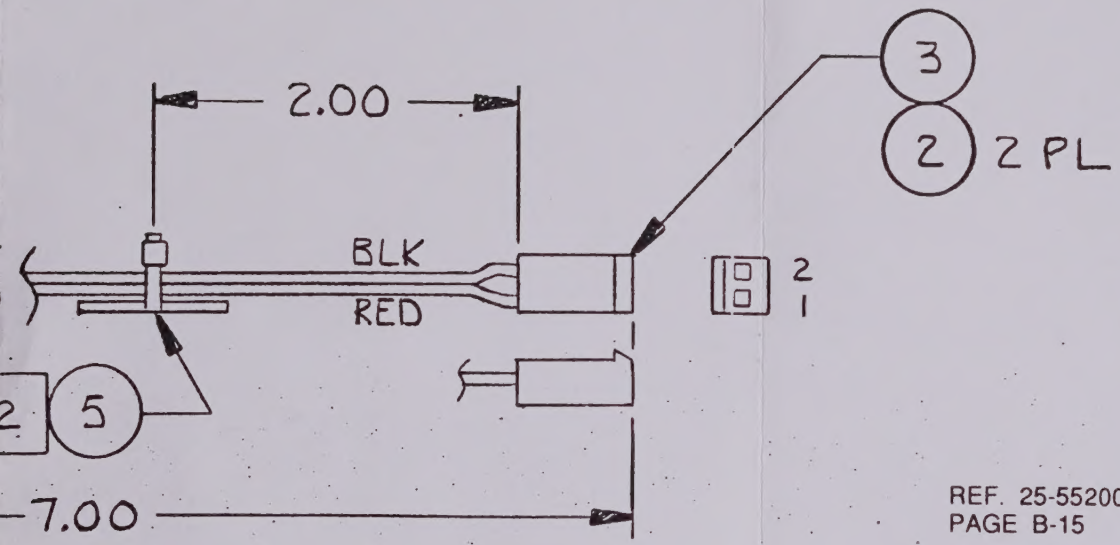
USED ON
5200

DO NO

BISHOP GRAPHICS ACCUPRESS
REORDER NO. A46291

DWG. NO. 25-55200-170 | SH 1 | REV A

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	RELEASE PER DRN 5200-02	3/23/93	M.E. Seeley



REF. 25-55200-170
PAGE B-15

PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
42-00252-010	CABLE-TIE MARKER, .75 DIA.	PANDUIT/PLMIM
42-00003-010	CABLE-TIE, .75 DIA	PANDUIT/SSTIM
34-00077-020	CONNECTOR, LOCKING, 2 POS.	MOLEX/09-50-3021
34-00072-010	CONTACT, CRIMP STYLE, 18-24 AWG	MOLEX/08-50-0105
31-00076-010	FAN, 24VDC, 13 CFM	COMAIR-ROTRON FS24H3-031159

PARTS LIST

GE SPECIFIED
N INCHES
IMALS ±.25 ANGLES ±
1

CONTRACT NO.

APPROVALS		DATE
DRAWN	M.E. SEELEY	3-3-93
CHECKED	M.E. Seeley	3-5-93
QA		
PROJECT ENG		3/19/93
ENGINEER	John Lester	3/23/93

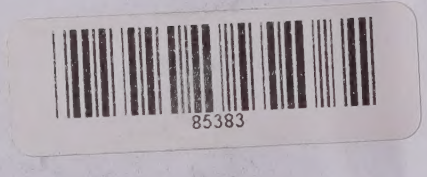
CALE DRAWING

CXR telcom
521 CHARCOT AVENUE
SAN JOSE CALIFORNIA 95131

CABLE, FAN, 5200-02

SIZE	FSCM NO.	DWG. NO.	REV.
B		25-55200-170	A

SCALE NONE | SHEET 1 OF 1



CXR telcom

521 Charcot Avenue, San Jose, CA 95131

(408) 435-8520 FAX (408) 435-1276